

EUROPEAN PATENT OFFICE

D-1

Patent Abstracts of Japan

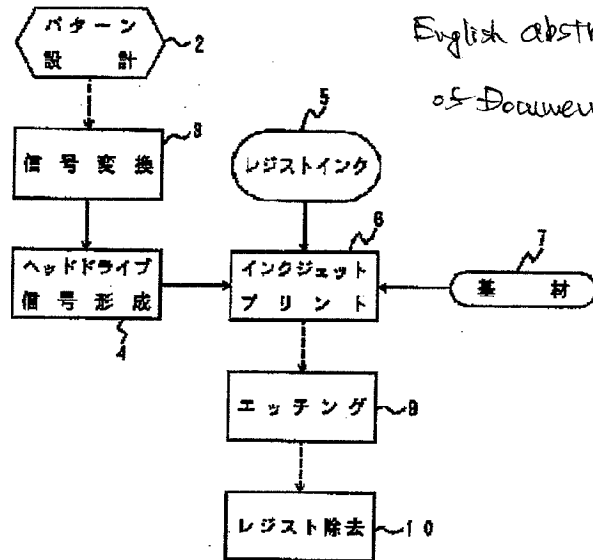
PUBLICATION NUMBER : 05338187
 PUBLICATION DATE : 21-12-93
 APPLICATION DATE : 11-06-92
 APPLICATION NUMBER : 04152469

APPLICANT : OLYMPUS OPTICAL CO LTD;

INVENTOR : NISHIKAWA MASA HARU;

INT.CL. : B41J 2/16 C23F 1/00 H05K 3/06
 H05K 3/14 H05K 3/18

TITLE : METHOD FOR FORMING RESIST
 PATTERN



ABSTRACT : PURPOSE: To easily form a resist pattern in an economical manner from an aspect of equipment or production cost using an inexpensive material without causing an environmental problem.

CONSTITUTION: In a resist pattern forming method for forming a resist film having a desired pattern on a base material 7 to be processed and adapted to post-processing generating a change in a part having no resist film on the basis of the difference between the properties of the surface due to the presence and absence of the resist film, an ink jet printer 6 drawing and printing an image on the basis of an image signal by the injection of ink is used and, as the ink of the ink jet printer 6, resist ink 5 is used. The image signal of a pattern to be formed is applied to the ink jet printer to print and form the pattern of the resist film due to the resist ink on the surface of the base material to be processed.

COPYRIGHT: (C)1993,JPO&Japio

*** NOTICES ***

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.*** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1]Form a resist tunic of a desired pattern in the surface of a substrate to be processed, and based on a difference of character of the surface by existence of a resist tunic, In a pattern formation method of the above-mentioned resist tunic for applying to a process of post processing of making a portion without a resist tunic producing change, Use ink for resist as ink of this ink-jet printer using an ink-jet printer which carries out drawing printing of the image by ink jet based on a picture signal, and. A resist pattern formation method giving a picture signal of a pattern which should be formed to this ink-jet printer, and carrying out print formation of the pattern of a resist tunic in ink for resist on a processing substrate side.

[Translation done.]

*** NOTICES ***

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.*** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]Based on the existence of the pattern on the process of forming the pattern by a resist tunic on the field of a substrate to be processed, and the above-mentioned field, this invention, A portion without a pattern is made to produce processing change, and it is related with the formation method and forming device of a resist pattern which are applied to the processing method using the resist pattern which comprises the process of advancing processing, protecting a pattern part from a machining action.

[0002]

[Description of the Prior Art]Form the pattern by a resist tunic on the field of a substrate to be processed, and a portion without a pattern is made to produce processing change based on the existence of the pattern on the above-mentioned field, and there is the processing method which was made to advance processing, protecting a pattern part from a machining action.

[0003]As an applicable field of such a processing method, etching of pattern state, plating of pattern state, vacuum evaporation of pattern state, the electrolytic oxidation of pattern state, etc. are publicly known, and practical use is widely presented with them.

[0004]Drawing 5 is a figure showing the process of a publicly known etching processing method.

[0005]If an etching processing method is explained based on figures, the substrate which can dissolve with etching reagents, such as various metal and polyimide, will be prepared, and washing processing for degreasing etc. will be first performed to this substrate. Subsequently, bake for removing adsorption moisture is performed.

[0006]Next, although resist attachment is performed, at the process of this resist attachment, the resist film which applied liquefied resist liquid or was beforehand processed in the shape of a film is stuck by pressure. And in a prebaking stage, the solvent of resist is evaporated and it removes.

[0007]On the other hand, the pattern for etching is designed using CAD (computer support design) etc., plot out of this designed pattern is carried out by a cutting plotter and the photoplotter, and a pattern check is carried out.

[0008]In this stage, plot out is carried out with a bigger magnifying power than the pattern usually processed. The pattern by which plot out was carried out is filmed with a camera next, and develops and film-izes this photoed film.

[0009]Thus, the obtained film is the original edition for exposure.

[0010]Next, prebake of the resist attachment is performed and carried out to the surface of a substrate. Next, the above-mentioned original edition for exposure is piled up on the surface of this substrate that carried out prebake, and ultraviolet rays exposure is performed from on the original edition. The pattern in the above-mentioned original edition for exposure has a transparent portion to leave by etching, and it is made for a portion to remove to become black.

[0011]When ultraviolet rays exposure is performed via the original edition for exposure, the portion

located in the transparent area of a pattern will polymerize and harden the resist on a substrate by ultraviolet rays. Therefore, it is exposure completion when resist polymerizes and hardens by ultraviolet rays. Perform developing process processing for removing an unhardened resist material after exposure, and a developing solution and a rinse are evaporated by postbake, and the adhesive strength of a hardening portion is heightened with heat, and the process of resist pattern formation is ended.

[0012] Thus, after finishing patterning of resist, it moves to an etching process.

[0013] It is made to act on the field which patterned the liquid which dissolves metal, such as ferric chloride and cupric chloride, chemically in the etching process of a substrate, and the metal of a portion without the resist pattern of a substrate is removed. And at the last process, it exfoliates or oxidizes, the resist film which became unnecessary is removed, and a whole process is ended.

[0014] It is a method of processing it other than etching, and the process to resist pattern formation will become the same also in the thing using a resist pattern.

[0015] The devices used in the above-mentioned resist pattern formation process are a set of a cleaning tank, a bake furnace, a resist application machine or a sticking-by-pressure machine, an ultraviolet-rays-exposure device, a resist developing machine, CAD, a cutting plotter or a photoplotter, a large-sized camera, and film processors, waste water treatment equipment, etc. As materials, a resist material, a cutting film, a photographic film, a set of photographic developing solutions, a wastewater treatment agent, etc. are used after washing.

[0016]

[Problem(s) to be Solved by the Invention] By the way, such a conventional resist pattern formation method has a complicated process, and requires a long time by pattern formation.

[0017] The talented people who had special knowledge and skill in work are needed, and also materials expensive for pattern formation are exhausted. It will be generated by the effluent and waste which have further again a possibility of polluting environment with the process of processing, and it is [equipment expensive for processing / variety] not only necessary, but since the occupation area of the equipment is large, it becomes what has immense plant-and-equipment investment, and also the great expense of ***** of equipment starts. It has many problems which must be solved, such as consuming a lot of energy and water for processing.

[0018] Therefore, resist pattern formation is easy, materials' is cheap, and ends, worries about an environmental problem do not have it, either, and there is a place made into the purpose of this invention in providing an economical resist pattern formation method also in respect of equipment or a production cost.

[0019]

[Means for Solving the Problem] This invention was performed as follows in order to attain the above-mentioned purpose. Namely, a resist tunic of a desired pattern is formed in the surface of a substrate to be processed, In a pattern formation method of the above-mentioned resist tunic for applying to a process of post processing of making a portion without a resist tunic producing change, based on a difference of character of the surface by existence of a resist tunic, Use ink for resist as ink of this ink-jet printer using an ink-jet printer which carries out drawing printing of the image by ink jet based on a picture signal, and. A picture signal of a pattern which should be formed is given to this ink-jet printer, and it was made to carry out print formation of the pattern of a resist tunic in ink for resist on a processing substrate side.

[0020] Ink for ultraviolet curing resist is made to inject, and it is made to carry out pattern formation, it irradiates with ultraviolet rays on this formed pattern concerned, and is made to make it harden from an ink jet print head.

[0021]

[Function] Thus, the ink-jet printer which carries out drawing printing of the resist image by injection of resist ink based on a picture signal in this invention is used, Resist pattern formation is performed by giving the picture signal of the pattern which should be formed to this ink-jet printer, and

carrying out print formation of the pattern of the resist tunic in the ink for resist on a processing substrate side.

[0022]According to this method, with the drive signal created based on the information received in the form of the picture signal. With the resist ink which is injected from the ink jet print head controlled, and adheres on a substrate to be processed, since a resist pattern is directly formed on a substrate, From not needing the original edition for making a pattern expose, but exposure of a photograph and a developing process becoming completely unnecessary. Since the part and materials are also cheap, end, and do not have worries about an environmental problem, and it becomes economical also in respect of equipment or a production cost and also it is the composition to which immediate printing of the drawing information is carried out, it becomes a resist pattern formation method which has the features, like resist pattern formation is very easy and there is.

[0023]By ultraviolet rays, carry out polymerization curing of the ink printed on the substrate to be processed by irradiating with ultraviolet rays on the pattern after printing, and making it make it harden using the ink for ultraviolet curing resist, and it serves as a firm tunic, and it comes to adhere firmly on a substrate.

[0024]

[Example]Hereafter, one example of this invention is described with reference to drawings.

[0025](Example 1 of a method) Drawing 1 is a figure showing the process of the resist pattern formation method by this invention. As shown in a figure, the process of the resist pattern formation by this invention designs the resist pattern which carries out and needs the design pattern process 2 of performing a design pattern first. Next, the signal transformation process 3 is carried out and it changes into the signal for printing this designed pattern. And the print head drive signal formation process 4 which changes the signal for [this] printing into the drive signal of a printer is carried out, and the ink jet printing process 6 of driving a printer according to the print head drive signal formed in this process is carried out.

[0026]At the ink jet printing process 6, the resist ink 5 is used and a ** resist pattern is printed on the substrate 7 to be processed with the resist ink 5. Then, it goes into the etching process 8 and the substrate 7 to be processed is etched, and if it is completed, the resist pattern on the substrate 7 which went into the resist removal process 9 and became no more use to be processed will be removed.

[0027]As mentioned above, in forming a resist pattern on the substrate 7 to be processed, by this invention, a resist pattern is formed by printing with an ink-jet printer, and the feature is at the point of having abolished the process of creation of the original edition, exposure, and development. This eliminates use of the medicine and water which were needed at the process of creation of the original edition, exposure, and development, and energy saving and laborsaving are attained.

[0028]Since it is the purpose to obtain the picture information of a resist pattern as a signal (data), the design pattern in the design pattern process 2, Although considering laborsaving and efficiency it is preferred to be carried out using a CAD system, original drawing created by handwork is read with an image scanner, and it changes into a picture signal, and may be made to obtain this as picture information.

[0029]It becomes the start of the process of this invention that the picture information of a pattern is changed into an electrical signal, and is supplied. The received signal is rearranged into the combination and an order of having been suitable for controlling an ink jet print head, in the signal transformation process 3. When the HARASHIN item is a vector signal, vector raster conversion is performed first and a raster picture signal is acquired.

[0030]A raster picture signal is changed into the signal sequence which ranks second and is decided in relation to the nozzle arrangement and the main-sub scanner of an ink jet print head. For example, in composition of that each nozzle operates simultaneously and an ink jet nozzle injects ink by multi-nozzle structure, corresponding to a nozzle arrangement position, two or more picture

signals are taken out one after another in synchronization, and it sends into the following head drive signal formation process. This process is a process of forming the voltage for carrying out the direct drive of the print head, and the signal of pulse width.

[0031]The following ink jet printing process 6 is a final process of patterning. In this process, the ink for resist is applied as Ink jet printing, Inc.

[0032]The character required of the ink for resist changes with kinds of work process performed to the next. For example, if a post process is a process using water-soluble treating solutions, such as etching, electroforming, electrolytic oxidation, first, the ink for resist needs to be a water resisting property, and also the 1st may be required to be acid-proof and alkali resistance from the formula of a treating solution.

[0033]Therefore, they are jet ink made to inject as ink optimal in this case where the heat dissolution of oily ink jet ink and solid wax is carried out, ink of the ultraviolet curing type described later, etc.

[0034]In the ink jet printing process 6, the substrate 7 to be processed is applied as an image reception area. When a post process is etching, as a substrate to be processed, the plastic of various kinds of metal, such as copper, nickel, and a stainless steel, or polyimide etc. which can be etched are applied.

[0035]When a post process is electroforming, conductive base materials, such as a metal plate, are applied. In this case, tunics, such as an oxide, chromate, and a sulfide, may be made to form in a surface of metal so that it may be easy to exfoliate a work.

[0036]Hardening of the ink which adhered on the substrate to be processed will end the whole process of resist pattern formation.

[0037]To drawing 1, the process of etching and resist removal was illustrated as an example of a post process. However, in the case of other processing methods, it becomes with a different process from this.

[0038]In performing etching processing, using a metal plate as the substrate 7 to be processed, the substrate in which the resist pattern was formed into etching fluid, such as ferric chloride and cupric chloride, is dipped, or etching fluid is poured out in the shape of a shower, and it advances etching. Although corrosion removal of the metal of a portion without a resist pattern is carried out by this, the metal under a resist pattern remains as it is. As a result, processing as the shape of a resist pattern can be performed.

[0039]Since a resist pattern remains without being etched, in order to remove this at the last, it goes into the resist removal process 10. Since the use in which the resist pattern may remain is also after etching, a resist removal process is removed in that case, since a resist pattern usually becomes obstructive, although it will omit.

[0040]although removal of a resist pattern softens a resist film with alkaline liquid etc. and is removed by applying there external force, such as a jet stream and brushing, — a resist pattern —
**** — when it is a thin film, it can also remove by plasma etching.

[0041]by the way, the feature of this invention is forming a resist pattern on printing a resist pattern directly on a substrate by an ink jet print head, although it is, It is very convenient to use ultraviolet curing resist ink as ink for resist made to adhere on a substrate by an ink jet print head.

[0042]For example, since ink is not solidified unless it irradiates with ultraviolet rays in the case of ultraviolet curing ink, the effect of preventing blinding of the ink jet nozzle by solidification of ink is acquired.

[0043]The formed resist pattern serves as a strong film by the exposure of ultraviolet rays, and the endurance to treating solutions which also use adhesive strength with a substrate by increase and a post process, such as an etching reagent and an electrolysis solution, increases, and the function as a resist pattern increases.

[0044](Example 2 of a method) Drawing 2 shows process drawing at the time of using ultraviolet curing ink as ink for resist. The differences with the example of drawing 1 are a point which applies

ultraviolet curing resist ink 5' to an ink jet printing process as ink for resist, and a point of having added the UV irradiation process 8 after the ink jet printing process.

[0045]The example of a formula of ultraviolet curing ink jet resist ink is shown below.

Paints or color : Adequate amount (good, even if there is nothing)

Sensitization material, such as an amino compound and ketone : 2-15 (weight ratio) Oligomer prepolymer (E. A, acrylic urethane, etc.) : 20-50 (weight ratio)

Reactive monomers (PETA, TMPTA, etc.) : 10-20 (weight ratio)

Additive agents (stabilizer, lubricant, etc.) : 0.1-5 (weight ratio)

It is [being an adequate amount, in addition] better to set, since it originally is not needed about colorant since a resist pattern is not a thing for viewing, but it is helpful when carrying out the visual judgment of whether patterning was performed normally.

[0046]In the etching processing for an ornament, although a resist pattern also has a use it is supposed that it has left, a visual effect may be raised to a resist pattern intentionally [colorant] in this case. Even if it is not an ultraviolet curing type, it is possible, but since the direction of the ultraviolet curing type won membranous intensity and an adhesive property, the resist ink in this case is preferred.

[0047]Next, although it is the ultraviolet curing process 8, at this process, using sources of ultraviolet radiation, such as a high-pressure mercury-vapor lamp, ultraviolet radiation with a wavelength of 250 nm - 350 nm is made to act, it polymerizes and a prepolymer is stiffened.

[0048](Example 1 of a device) The resist pattern forming device which applied the resist pattern formation method of this invention mentioned above next is explained with reference to drawing 3.

[0049]Drawing 3 (a) is a lineblock diagram of the resist pattern forming device by this invention, and drawing 3 (b) is a front view of the orifice plate of the ink jet print head used with this device.

[0050]In drawing 3 (a), a base plate and 12 11 A guide post, A guide post beam and 14 for 13 a boarding ramp and 15 a boarding ramp arm, and 16 and 17 A slide rail, 18 and 19 a slide bearing and 20 a bearing receptacle and 21 Wire hooks, A wire and 23 for 22 a wire pulley and 24 a motor backing plate and 25 A horizontal-scanning motor, A cam follower and 26 for 27 a cam follower axis and 29 a cam and 28 A cam shaft, 30 a vertical-scanning motor and 31 a move scanning stand and 32 An ink jet print head, An orifice plate and 34 for 33 a suction buck and 35 a suction opening and 36 An exhaust port, 37 -- a ventilating fan and 38 -- a substrate to be processed and 39 -- a support and 40 -- a signal transformation circuit and 43 show 44, a head driver circuit and 45 show the Motor Driver circuit, and, as for a receiving circuit and 42, pattern CAD and 41 show the control circuit 46.

*** NOTICES ***

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.*** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]Based on the existence of the pattern on the process of forming the pattern by a resist tunic on the field of a substrate to be processed, and the above-mentioned field, this invention, A portion without a pattern is made to produce processing change, and it is related with the formation method and forming device of a resist pattern which are applied to the processing method using the resist pattern which comprises the process of advancing processing, protecting a pattern part from a machining action.

[0002]

[Description of the Prior Art]Form the pattern by a resist tunic on the field of a substrate to be processed, and a portion without a pattern is made to produce processing change based on the existence of the pattern on the above-mentioned field, and there is the processing method which was made to advance processing, protecting a pattern part from a machining action.

[0003]As an applicable field of such a processing method, etching of pattern state, plating of pattern state, vacuum evaporation of pattern state, the electrolytic oxidation of pattern state, etc. are publicly known, and practical use is widely presented with them.

[0004]Drawing 5 is a figure showing the process of a publicly known etching processing method.

[0005]If an etching processing method is explained based on figures, the substrate which can dissolve with etching reagents, such as various metal and polyimide, will be prepared, and washing processing for degreasing etc. will be first performed to this substrate. Subsequently, bake for removing adsorption moisture is performed.

[0006]Next, although resist attachment is performed, at the process of this resist attachment, the resist film which applied liquefied resist liquid or was beforehand processed in the shape of a film is stuck by pressure. And in a prebaking stage, the solvent of resist is evaporated and it removes.

[0007]On the other hand, the pattern for etching is designed using CAD (computer support design) etc., plot out of this designed pattern is carried out by a cutting plotter and the photoplotter, and a pattern check is carried out.

[0008]In this stage, plot out is carried out with a bigger magnifying power than the pattern usually processed. The pattern by which plot out was carried out is filmed with a camera next, and develops and film-izes this photoed film.

[0009]Thus, the obtained film is the original edition for exposure.

[0010]Next, prebake of the resist attachment is performed and carried out to the surface of a substrate. Next, the above-mentioned original edition for exposure is piled up on the surface of this substrate that carried out prebake, and ultraviolet rays exposure is performed from on the original edition. The pattern in the above-mentioned original edition for exposure has a transparent portion to leave by etching, and it is made for a portion to remove to become black.

[0011]When ultraviolet rays exposure is performed via the original edition for exposure, the portion

located in the transparent area of a pattern will polymerize and harden the resist on a substrate by ultraviolet rays. Therefore, it is exposure completion when resist polymerizes and hardens by ultraviolet rays. Perform developing process processing for removing an unhardened resist material after exposure, and a developing solution and a rinse are evaporated by postbake, and the adhesive strength of a hardening portion is heightened with heat, and the process of resist pattern formation is ended.

[0012] Thus, after finishing patterning of resist, it moves to an etching process.

[0013] It is made to act on the field which patterned the liquid which dissolves metal, such as ferric chloride and cupric chloride, chemically in the etching process of a substrate, and the metal of a portion without the resist pattern of a substrate is removed. And at the last process, it exfoliates or oxidizes, the resist film which became unnecessary is removed, and a whole process is ended.

[0014] It is a method of processing it other than etching, and the process to resist pattern formation will become the same also in the thing using a resist pattern.

[0015] The devices used in the above-mentioned resist pattern formation process are a set of a cleaning tank, a bake furnace, a resist application machine or a sticking-by-pressure machine, an ultraviolet-rays-exposure device, a resist developing machine, CAD, a cutting plotter or a photoplotter, a large-sized camera, and film processors, waste water treatment equipment, etc. As materials, a resist material, a cutting film, a photographic film, a set of photographic developing solutions, a wastewater treatment agent, etc. are used after washing.

[0016]

[Problem(s) to be Solved by the Invention] By the way, such a conventional resist pattern formation method has a complicated process, and requires a long time by pattern formation.

[0017] The talented people who had special knowledge and skill in work are needed, and also materials expensive for pattern formation are exhausted. It will be generated by the effluent and waste which have further again a possibility of polluting environment with the process of processing, and it is [equipment expensive for processing / variety] not only necessary, but since the occupation area of the equipment is large, it becomes what has immense plant-and-equipment investment, and also the great expense of ***** of equipment starts. It has many problems which must be solved, such as consuming a lot of energy and water for processing.

[0018] Therefore, resist pattern formation is easy, materials' is cheap, and ends, worries about an environmental problem do not have it, either, and there is a place made into the purpose of this invention in providing an economical resist pattern formation method also in respect of equipment or a production cost.

[0019]

[Means for Solving the Problem] This invention was performed as follows in order to attain the above-mentioned purpose. Namely, a resist tunic of a desired pattern is formed in the surface of a substrate to be processed. In a pattern formation method of the above-mentioned resist tunic for applying to a process of post processing of making a portion without a resist tunic producing change, based on a difference of character of the surface by existence of a resist tunic, Use ink for resist as ink of this ink-jet printer using an ink-jet printer which carries out drawing printing of the image by ink jet based on a picture signal, and. A picture signal of a pattern which should be formed is given to this ink-jet printer, and it was made to carry out print formation of the pattern of a resist tunic in ink for resist on a processing substrate side.

[0020] Ink for ultraviolet curing resist is made to inject, and it is made to carry out pattern formation, it irradiates with ultraviolet rays on this formed pattern concerned, and is made to make it harden from an ink jet print head.

[0021]

[Function] Thus, the ink-jet printer which carries out drawing printing of the resist image by injection of resist ink based on a picture signal in this invention is used, Resist pattern formation is performed by giving the picture signal of the pattern which should be formed to this ink-jet printer, and

carrying out print formation of the pattern of the resist tunic in the ink for resist on a processing substrate side.

[0022]According to this method, with the drive signal created based on the information received in the form of the picture signal. With the resist ink which is injected from the ink jet print head controlled, and adheres on a substrate to be processed, since a resist pattern is directly formed on a substrate, From not needing the original edition for making a pattern expose, but exposure of a photograph and a developing process becoming completely unnecessary. Since the part and materials are also cheap, end, and do not have worries about an environmental problem, and it becomes economical also in respect of equipment or a production cost and also it is the composition to which immediate printing of the drawing information is carried out, it becomes a resist pattern formation method which has the features, like resist pattern formation is very easy and there is.

[0023]By ultraviolet rays, carry out polymerization curing of the ink printed on the substrate to be processed by irradiating with ultraviolet rays on the pattern after printing, and making it make it harden using the ink for ultraviolet curing resist, and it serves as a firm tunic, and it comes to adhere firmly on a substrate.

[0024]

[Example]Hereafter, one example of this invention is described with reference to drawings.

[0025](Example 1 of a method) Drawing 1 is a figure showing the process of the resist pattern formation method by this invention. As shown in a figure, the process of the resist pattern formation by this invention designs the resist pattern which carries out and needs the design pattern process 2 of performing a design pattern first. Next, the signal transformation process 3 is carried out and it changes into the signal for printing this designed pattern. And the print head drive signal formation process 4 which changes the signal for [this] printing into the drive signal of a printer is carried out, and the ink jet printing process 6 of driving a printer according to the print head drive signal formed in this process is carried out.

[0026]At the ink jet printing process 6, the resist ink 5 is used and a ** resist pattern is printed on the substrate 7 to be processed with the resist ink 5. Then, it goes into the etching process 8 and the substrate 7 to be processed is etched, and if it is completed, the resist pattern on the substrate 7 which went into the resist removal process 9 and became no more use to be processed will be removed.

[0027]As mentioned above, in forming a resist pattern on the substrate 7 to be processed, by this invention, a resist pattern is formed by printing with an ink-jet printer, and the feature is at the point of having abolished the process of creation of the original edition, exposure, and development. This eliminates use of the medicine and water which were needed at the process of creation of the original edition, exposure, and development, and energy saving and laborsaving are attained.

[0028]Since it is the purpose to obtain the picture information of a resist pattern as a signal (data), the design pattern in the design pattern process 2, Although considering laborsaving and efficiency it is preferred to be carried out using a CAD system, original drawing created by handwork is read with an image scanner, and it changes into a picture signal, and may be made to obtain this as picture information.

[0029]It becomes the start of the process of this invention that the picture information of a pattern is changed into an electrical signal, and is supplied. The received signal is rearranged into the combination and an order of having been suitable for controlling an ink jet print head, in the signal transformation process 3. When the HARASHIN item is a vector signal, vector raster conversion is performed first and a raster picture signal is acquired.

[0030]A raster picture signal is changed into the signal sequence which ranks second and is decided in relation to the nozzle arrangement and the main-sub scanner of an ink jet print head. For example, in composition of that each nozzle operates simultaneously and an ink jet nozzle injects ink by multi-nozzle structure, corresponding to a nozzle arrangement position, two or more picture

signals are taken out one after another in synchronization, and it sends into the following head drive signal formation process. This process is a process of forming the voltage for carrying out the direct drive of the print head, and the signal of pulse width.

[0031]The following ink jet printing process 6 is a final process of patterning. In this process, the ink for resist is applied as Ink jet printing, Inc.

[0032]The character required of the ink for resist changes with kinds of work process performed to the next. For example, if a post process is a process using water-soluble treating solutions, such as etching, electroforming, electrolytic oxidation, first, the ink for resist needs to be a water resisting property, and also the 1st may be required to be acid-proof and alkali resistance from the formula of a treating solution.

[0033]Therefore, they are jet ink made to inject as ink optimal in this case where the heat dissolution of oily ink jet ink and solid wax is carried out, ink of the ultraviolet curing type described later, etc.

[0034]In the ink jet printing process 6, the substrate 7 to be processed is applied as an image reception area. When a post process is etching, as a substrate to be processed, the plastic of various kinds of metal, such as copper, nickel, and a stainless steel, or polyimide etc. which can be etched are applied.

[0035]When a post process is electroforming, conductive base materials, such as a metal plate, are applied. In this case, tunics, such as an oxide, chromate, and a sulfide, may be made to form in a surface of metal so that it may be easy to exfoliate a work.

[0036]Hardening of the ink which adhered on the substrate to be processed will end the whole process of resist pattern formation.

[0037]To drawing 1, the process of etching and resist removal was illustrated as an example of a post process. However, in the case of other processing methods, it becomes with a different process from this.

[0038]In performing etching processing, using a metal plate as the substrate 7 to be processed, the substrate in which the resist pattern was formed into etching fluid, such as ferric chloride and cupric chloride, is dipped, or etching fluid is poured out in the shape of a shower, and it advances etching. Although corrosion removal of the metal of a portion without a resist pattern is carried out by this, the metal under a resist pattern remains as it is. As a result, processing as the shape of a resist pattern can be performed.

[0039]Since a resist pattern remains without being etched, in order to remove this at the last, it goes into the resist removal process 10. Since the use in which the resist pattern may remain is also after etching, a resist removal process is removed in that case, since a resist pattern usually becomes obstructive, although it will omit.

[0040]although removal of a resist pattern softens a resist film with alkaline liquid etc. and is removed by applying there external force, such as a jet stream and brushing, --- a resist pattern --- **** --- when it is a thin film, it can also remove by plasma etching.

[0041]by the way, the feature of this invention is forming a resist pattern on printing a resist pattern directly on a substrate by an ink jet print head, although it is, It is very convenient to use ultraviolet curing resist ink as ink for resist made to adhere on a substrate by an ink jet print head.

[0042]For example, since ink is not solidified unless it irradiates with ultraviolet rays in the case of ultraviolet curing ink, the effect of preventing blinding of the ink jet nozzle by solidification of ink is acquired.

[0043]The formed resist pattern serves as a strong film by the exposure of ultraviolet rays, and the endurance to treating solutions which also use adhesive strength with a substrate by increase and a post process, such as an etching reagent and an electrolysis solution, increases, and the function as a resist pattern increases.

[0044](Example 2 of a method) Drawing 2 shows process drawing at the time of using ultraviolet curing ink as ink for resist. The differences with the example of drawing 1 are a point which applies

ultraviolet curing resist ink 5' to an ink jet printing process as ink for resist, and a point of having added the UV irradiation process 8 after the ink jet printing process.

[0045]The example of a formula of ultraviolet curing ink jet resist ink is shown below.

Paints or color : Adequate amount (good, even if there is nothing)

Sensitization material, such as an amino compound and ketone : 2-15 (weight ratio) Oligomer prepolymer (E. A, acrylic urethane, etc.) : 20-50 (weight ratio)

Reactive monomers (PETA, TMPTA, etc.) : 10-20 (weight ratio)

Additive agents (stabilizer, lubricant, etc.) : 0.1-5 (weight ratio)

It is [being an adequate amount, in addition] better to set, since it originally is not needed about colorant since a resist pattern is not a thing for viewing, but it is helpful when carrying out the visual judgment of whether patterning was performed normally.

[0046]In the etching processing for an ornament, although a resist pattern also has a use it is supposed that it has left, a visual effect may be raised to a resist pattern intentionally [colorant] in this case. Even if it is not an ultraviolet curing type, it is possible, but since the direction of the ultraviolet curing type won membranous intensity and an adhesive property, the resist ink in this case is preferred.

[0047]Next, although it is the ultraviolet curing process 8, at this process, using sources of ultraviolet radiation, such as a high-pressure mercury-vapor lamp, ultraviolet radiation with a wavelength of 250 nm - 350 nm is made to act, it polymerizes and a prepolymer is stiffened.

[0048](Example 1 of a device) The resist pattern forming device which applied the resist pattern formation method of this invention mentioned above next is explained with reference to drawing 3.

[0049]Drawing 3 (a) is a lineblock diagram of the resist pattern forming device by this invention, and drawing 3 (b) is a front view of the orifice plate of the ink jet print head used with this device.

[0050]In drawing 3 (a), a base plate and 12 11 A guide post, A guide post beam and 14 for 13 a boarding ramp and 15 a boarding ramp arm, and 16 and 17 A slide rail, 18 and 19 a slide bearing and 20 a bearing receptacle and 21 Wire hooks, A wire and 23 for 22 a wire pulley and 24 a motor backing plate and 25 A horizontal-scanning motor, A cam follower and 26 for 27 a cam follower axis and 29 a cam and 28 A cam shaft, 30 a vertical-scanning motor and 31 a move scanning stand and 32 An ink jet print head, An orifice plate and 34 for 33 a suction buck and 35 a suction opening and 36 An exhaust port, 37 -- a ventilating fan and 38 -- a substrate to be processed and 39 -- a support and 40 -- a signal transformation circuit and 43 show 44, a head driver circuit and 45 show the Motor Driver circuit, and, as for a receiving circuit and 42, pattern CAD and 41 show the control circuit 46.

[0051]2 and an interval are kept, and the above-mentioned guide post 12 stands erect and is arranged at the upper surface end close-attendants side of the above-mentioned base plate 11. The guide post 12 is a cylindrical member, the upper bed of the guide post 12 of this couple is fixed by being built over the guide post beam 13, and an arch shape frame is formed.

[0052]The boarding ramp 14 which shows around at this guide post 12 and it goes up and down is inserted in the guide post 12 of a couple. A slide bearing is inserted in and the field which touches the guide post 12 of the boarding ramp 14 has come to be able to perform smooth rise and fall.

[0053]The boarding ramp arm 15 lengthens an arm in the boarding ramp 14 horizontally, and is provided in it, and it is provided in the tip close-attendants side of this arm so that it may be built over the two slide rails 16 and 17.

[0054]And although the move scanning stand 31 is attached to these slide rails 16 and 17 therefore, the slide bearings 18 and 19 are inserted in the bearing receptacle 20, and the slide rails 16 and 17 make the slide bearings 18 and 19 penetrate.

[0055]There are the wire hooks 21 in the move scanning stand 31, and the wire 22 is fixed. It is built over the wire 22 between the wire pulley 23 attached to the axis of the horizontal-scanning motor 25, and the wire pulley attached to the boarding ramp arm of another side which is not illustrated enabling free rotation, and if the horizontal-scanning motor 25 rotates, it has composition which the

move scanning stand 31 moves in a slide rail top.

[0056]The cam follower 27 is attached to the boarding ramp 14 with the axis 26, and the cam 29 supports a boarding ramp. And there is the coiled spring S in the upper bed side of the boarding ramp 14, and the boarding ramp 14 is energized below.

[0057]The axis 28 is fixed and attached to the cam 29, and although not illustrated, this axis 28 is supported pivotally by the bearing attached to the base plate 11, and it has structure connected with the axis of the vertical-scanning motor 30. Therefore, rotation of the vertical-scanning motor 30 has composition transmitted to the cam 29 via this axis 28, and it has composition in which the cam follower 27 which is in contact with the side part of the cam 29 goes up and down with rotation of the cam 29 and which can carry out rise-and-fall driving operation of the boarding ramp 14.

[0058]The ink jet print head 32 is carried in the move scanning stand 31. And the ink for resist is used for this ink jet print head 32.

[0059]If the orifice plate 33 of the ink jet print head 32 is seen from a transverse plane, as shown in drawing 3 (b), two or more ink jet nozzles N are formed. The ink jet nozzle N is arranged in two dimensions, the height position is changed small [every] and each nozzle N has multi-nozzle structure which can inject ink in synchronization.

[0060]If rotation of the horizontal-scanning motor 25 is told to the wire 22 with a belt pulley, the wire 22 moves the move scanning stand 31 along with the slide rails 16 and 17 and the ink jet print head 32 is operated in the meantime, the print by resist ink will be performed to the band-like scan size of the width W.

[0061]Although you can make it go up and down the boarding ramp 14 by rotating the vertical-scanning motor 30, it is made for the quantity to be W per time.

[0062]The suction buck 34 attached on the base plate 11 so that the ink jet print head 32 might be countered is made to support the substrate 38 used as the printing object of a resist pattern to be processed. This suction buck 34 is case shape, the exhaust port 36 is established in the back side, and the ventilating fan 37 is attached to the exhaust port part. Two or more suction openings 35 are formed in the side front of the box-like suction buck 34, and if the ventilating fan 37 is rotated, air will be inhaled in the box of the buck 34 as 35 copies in a suction opening. Therefore, if the substrate 38 to be processed is put on the front face, it is the structure held with negative pressure.

[0063]Therefore, after making the suction buck 34 carry out adsorption maintenance of the substrate 38 used as the printing object of a resist pattern to be processed, Rotating the horizontal-scanning motor 25, telling the rotation to the wire 22 with a belt pulley, and moving the move scanning stand 31 along with the slide rails 16 and 17. If print operation of the ink jet print head 32 is carried out with a picture signal, Whenever the print by resist ink is performed to the band-like scan size of the width W and it finishes this horizontal scanning, One band-like scan size after another is expanded, and a scan size can be extended to the whole surface of the substrate 38 to be processed, and it can go to it by repeating the operation referred to as rotating the vertical-scanning motor 30, and only W shifting the boarding ramp 14, and moving the move scanning stand 31 to a scanning direction again. And according to a picture signal, a resist pattern can be printed all over the substrate 38 to be processed.

[0064]The information on the pattern made to form on the substrate 38 to be processed with this device is supplied in the form of an electrical signal. It is pattern CAD system 40 which the information on a pattern is created and is outputted in the form of an electrical signal, and pattern CAD system 40 explained here is an example of a host side device.

[0065]Although the pattern signal which is a pattern information output from pattern CAD system 40 is received in the receiving circuit 41, interface circuitry and a buffer memory are contained in the receiving circuit 41. The signal received in the receiving circuit 41 is sent into the signal transformation circuit 42. If a pattern signal is a vector signal, it will change into a raster signal in this signal transformation circuit 42.

[0066]In this signal transformation circuit 42, signal transformation for making ink inject in synchronization and carrying out pattern formation from each orifice, based on the orifice composition of the ink jet print head 32 as shown by drawing 3 (b), is performed.

[0067]The changed signal is changed into the drive signal of the voltage and pulse width which were made suitable for it being sent into the driver circuit 43 and each ink jet orifice element operating. For example, in the case of the print head using the piezo-electric element as the ink jet print head 32, the waveform of the voltage abbreviation 100V and 100 microseconds (microsecond) of pulse width numbers is a typical driving pulse waveform.

[0068]The drive circuits for carrying out drive controlling of the motors (a pulse motor or a servo motor) 25 for a main-sub scan are 44 and 45. The main-sub scanning movement mentioned above and the drive of the ink jet print head 32 for pattern formation need the interlocked control, and the control circuit 46 is formed so that control for it can be performed. This control circuit 46 also performs the flow of the mutual signal between the device 40 by the side of a host, and the resist pattern forming device of this invention, and motion control simultaneously.

[0069]following the contents of a design, if a pattern is designed by having such composition -- the ink jet print head 32 -- the Lord -- and the resist film of the designed pattern can be printed on the processing substrate 38 surface on the suction buck 34, carrying out vertical scanning.

[0070]As mentioned above, in the example of drawing 3, it was made to move the ink jet print head to both directions in every direction (Lord and vertical scanning), and the substrate to be processed showed the composition which is fixed and forms a resist pattern.

[0071]Since all the move elements for pattern formation are performed in the example of a print head in this composition, even if shape, a size, etc. of a substrate to be processed change, there is the feature that pattern formation is possible and a scope is wide.

[0072]The structure of these scanners or ink jet print heads and a principle of operation are not limited to this example. When carrying out pattern formation on the thin substrate of a flexible sheet shaped like a flexible printed circuit board and a thin metal plate, it can be considered as sub scan feeding by supporting on both sides of two points, or rolling round both ends to the transportation roller which makes a pair, and moving a substrate to it. Drum lifting can be made to be able to support a substrate, as shown in the following example, and rotation of a drum can also be used for a scan.

[0073]An ink jet print head is not limited to the thing of multi-nozzle structure on demand type, either, but the head of a KONTINIASU method can also apply it.

[0074](Example 2 of a device) The advantage of using as ultraviolet curing ink the resist ink used for resist pattern formation is as having explained previously.

[0075]By the way, when ultraviolet curing ink is applied, Although a substrate to be processed may be sent into a black light after the pattern formation by an ink jet print head and ink may be stiffened, within the resist pattern forming device of this invention, If the ultraviolet ray source is arranged in the position which faces the passage of a substrate to be processed, the whole process of resist pattern formation can be terminated with this device.

[0076]Drawing 4 is an example of the device for realizing such a thing.

[0077]In a figure, the element which attached the numerals from 16 to 46' is the same as the element of the same sign in drawing 3. 50 [and] -- a substrate to be processed and 53 show a high-pressure mercury-vapor lamp, 54 shows a lamp cover, and, as for a grip and 52, a substrate holding drum and 51 show the mercury-vapor lamp light circuit 55, respectively.

[0078]In this example figure, ultraviolet curing resist ink is applied to the ink jet print head 32, the carrying path of a substrate to be processed is faced, and an ultraviolet ray source is arranged. The drum 50 has formed the grip 51 for supporting a substrate to be processed on that peripheral surface, and after it twists a substrate to be processed around the peripheral surface of the drum 50, it has considered it as the composition which makes a substrate to be processed hold to the peripheral surface of the drum 50 by fixing the end of a substrate to be processed by this grip 51.

[0079]And motor 30' for rotating the drum 50 is provided, and the vertical scanning direction of a substrate to be processed is made to scan by rotating the drum 50 by this motor 30'.

[0080]By such composition, in the case of the flexible sheet shaped based material of a metallic thin plate, flexible printed circuit board material, etc., a substrate to be processed can make the tip and back end able to hold by the grip 51, and can carry out adhesion maintenance on the drum 50.

[0081]In the case of this device, the ink jet print head 32 counters the drum 50, and is arranged, and it allocates the high-pressure mercury-vapor lamp 53 for UV irradiation in the peripheral surface of the drum 50.

[0082]The ink jet print head 32 is laid in the move scanning stand 31, moves the slide rail 16 and 17 top to a scanning direction, and injects resist ink to a band-like field. Drive controlling of motor 30' for drum rotations is carried out by driver circuit 45' for every reciprocation movement of the ink jet print head 32, the drum 50 is moved to an arrow direction and one injection field of resist ink after another is extended only for width W minutes of the above-mentioned strip region.

[0083]If the field in which the pattern by resist ink was formed comes to the ultraviolet radiation irradiation area of the high-pressure mercury-vapor lamp 53, the resist ink injected by pattern state will polymerize, will be hardened, and will change to a firm tunic required as a resist film.

[0084]Thus, if it has composition which performs the Lord and vertical scanning combining movement of a workpiece, and movement of a print head, there are also few spaces of the moving mechanism for a scan, and it ends, and the mechanism for movement can also be simplified.

[0085]Naturally it is also possible to change so that rotation of a drum may perform horizontal scanning in the drawing 4 composition and vertical scanning may be performed by movement of a print head. Thus, its workpiece is flexible at a sheet shaped, and the composition which is made to move a workpiece and is scanned is easy to apply when light moreover.

[0086]As explained above, the resist tunic of a desired pattern is formed in the surface of a substrate to be processed in this invention, As the above-mentioned resist pattern formation method for applying to the process of post processing of making a portion without a resist tunic producing change, based on the difference of the character of the surface by the existence of a resist tunic, Use the ink for resist as ink of this ink-jet printer using the ink-jet printer which carries out drawing printing of the image by ink jet based on a picture signal, and. The picture signal of the pattern which should be formed is given to this ink-jet printer, and it was made to carry out print formation of the pattern of the resist tunic in the ink for resist on the processing substrate side. Therefore, the process of pattern formation can be simple, and it can end for a short time, and a resist pattern can form special ***** knowledge and a help now in *****.

[0087]There are also few materials consumed for pattern formation, and there is also no generating of an effluent and waste which pollute environment. The device of pattern formation is also simple and small and the effect which said the occupation area that there are also few resources consumed few, such as energy and water, and they end is acquired.

[0088]As a device which realizes the resist pattern formation method by such a process, A means to support a substrate to be processed, and the ink jet print head which applied the ink for resist, The resist pattern forming device consisted of signal transformation circuits which make a means to carry out relative displacement of a substrate to be processed and the ink jet print head, and to scan them, and the signal which operates a print head driver line in response to a resist pattern picture signal. A described method can be materialized now by this.

[0089]The process which makes a described method inject the ink for ultraviolet curing resist, and carries out pattern formation to it on a processing substrate side further from the ink jet print head controlled by the pattern picture signal, and the process which irradiates with and stiffens ultraviolet rays on the above-mentioned pattern were added.

[0090]According to this, blinding of an ink jet nozzle can be prevented, reliability can be improved, resist ink can be stiffened for a short time certainly, and the membranous quality of the resist

tunic moreover formed produces the effect which improves an adhesive property with a substrate strongly.

[0091]As a device which realizes the resist pattern formation method by such a process, A means to support a substrate to be processed, and the ink jet print head which applied the ink for ultraviolet curing resist, A means to carry out relative displacement of a substrate to be processed and the ink jet print head, and to scan them, The resist pattern forming device consisted of signal transformation circuits which make the ultraviolet ray source arranged in the passage face of a substrate to be processed, and the signal which operates a print head driver line in response to a resist pattern picture signal. A described method can be materialized now by this.

[0092]Next, since it examined applying this invention to solid thing manufacture, this is explained hereafter.

(Background) Nikkei mechanical 1991.No. 7.8 Manufacturing a solid thing based on the sectional view sliced by height directions, such as a CAD designing sectional view and a contour map of a map, is known as shown in the pages 56-59.

[0093]And there is a pure mechanical manufacturing method of laminating what carried out pattern processing to the plate corresponding to the unit thickness of for example, each section as the technique.

[0094]Ultraviolet curing resin is scanned as a manufacturing method do not use a mechanical means, with the ultraviolet laser modulated with the pattern signal, pattern state is stiffened, and the method of laminating this hardening layer one after another, and making a solid thing is known.

[0095]Drawing 6 is a figure explaining the above-mentioned solid thing manufacturing method. The ultraviolet curing resin 202 is first put in the container 201. The boarding ramp 203 which supports a work is formed into the container 201. A boarding ramp is sunk into resin liquid, and height adjustment of the boarding ramp is carried out so that a slightly thin solution layer may be made on a boarding ramp side. And it scans in two dimensions, irradiating with the ultraviolet laser beam 205 which was based on the thin ultraviolet-curing-resin oil level in the fault figure, and was modulated.

[0096]The portion which received UV irradiation serves as a film which carried out polymerization curing so that numerals 204' might be attached and shown. If the solid thing manufactured is set to 204 of drawing 7 (a), sectional shape will be inputted as lamination which subdivided the solid in the height direction. The sectional view of the typical layers 204A, 204B, and 204C in it is shown in each (b), (c), and (d).

[0097]Solid formation is performed from the bottom of the heap, and after hardening of one layer is completed, once it sinks a boarding ramp under a resin liquid side, it returns to predetermined height again. and the already formed hardening layer top -- further the next -- the non-sclerosing solution film of a part is made further, and scanning exposure is carried out, modulating an ultraviolet ray beam towards this layer. By repeating such a process, a hardening layer is piled up further every and a solid thing is manufactured.

[0098]In a (problem) and the manufacturing method of the solid-with time thing using such conventional ultraviolet curing resin, The large-sized and expensive laser light source and beam scanner for having to prepare a lot of unhardened ultraviolet curing resin, and obtaining a powerful ultraviolet radiation beam compared with the thing manufactured, are needed, therefore the occupation area of a device will also be large, will be high-cost, and will be a large-scale device.

[0099]Since it is the method of accumulating a hardening layer one by one and going from the bottom, in the case of a solid thing as shown in drawing 8, it can accumulate one by one from the bottom 206, and a field like 207 which can be supported can be manufactured, but a shaped part without the portion which should be supported to a lower layer or an adjoining part like 208 cannot be manufactured.

[0100]These faults are compensated, it is simple and small composition and the amount of ultraviolet curing resin to be used also explains hereafter the solid thing manufacturing method which is few and has few restrictions of the shape of the solid which can be manufactured.

[0101](Outline of an example) In this invention, in order to solve the fault of the conventional solid thing manufacturing method, [1] The process of being the method of manufacturing a solid thing based on the slice top view signal which shows the sectional shape for every layer subdivided by height direction, and creating the slice top view of a solid thing, The print signal converting process which changes a slice top view signal into the signal which energizes an ink jet head, The process of energizing an ink jet head based on the above-mentioned signal, and injecting an ultraviolet-curing-resin drop towards a drop receptacle side, It solved in repeating each above-mentioned process for every slice flat surface, performing it, and laminating it one by one using the process of irradiating with ultraviolet rays towards the ultraviolet-curing-resin drop of the pattern state on a drop receptacle side.

[0102]The ultraviolet-curing-resin liquid which injected this solid thing according to the signal sent in in the form of the sectional view according to the ink jet head and scanner of small and simple composition according to the manufacturing method is made to irradiate with and harden ultraviolet rays, From repeating this process and manufacturing a solid thing, a required resin amount can be managed a little with the upper ***** minimum quantity in the volume of a solid thing, and a device's is cheap, and its occupation area is also small, and it ends.

[0103][2] The process of creating the buck pattern drawing showing the shape of the buck for supporting some solid things in a manufacturing process in . and [1] based on the slice top view showing the shape of a solid thing, The print signal converting process changed into the signal which energizes other ink jet orifices based on the above-mentioned pattern drawing, Based on the above-mentioned signal, pace was made to keep with the drip injection for solid thing formation, the process of injecting the drop for removable buck formation was added for every slice flat-surface formation, and the process of removing a buck from a solid thing further after the drip injection process of all the slice flat surfaces and the end of a UV irradiation process was added.

[0104]According to this method, a required buck is manufactured simultaneously with a solid thing on a manufacturing process, and a supporter can be removed eventually, it can leave only a solid thing, and restrictions of the shape of the solid thing which can be manufactured can be made to ease substantially.

[0105][3] The process of creating the pattern drawing of the buck for supporting some solid things during a solid thing and manufacture in . and [1] based on the slice top view showing the shape of a solid thing, The pattern drawing creation process which shows the interface of the above-mentioned solid thing and a buck, and the process of injecting an ultraviolet curing drop based on a solid thing and a buck pattern drawing, The process of making pace keeping with the above-mentioned process, and injecting a release agent drop based on an interface pattern drawing, and the process of removing a buck from a solid thing after the drip injection process of all the slice flat surfaces and the end of a UV irradiation process were added.

[0106]According to this method, a required buck is manufactured simultaneously with a solid thing on a manufacturing process, and a supporter can be removed eventually, it can leave only a solid thing, and restrictions of the shape of the solid thing which can be manufactured can be made to ease substantially.

[0107][4] The process of carrying out scanning movement of a drop receptacle side and the ink jet head in . and also the 1st direction, and injecting the drop for every slice flat surface, It was made to repeat periodically the process of rotating relatively a drop receptacle side and the scanning direction of an ink jet head in the direction other than the 1st direction of the above, and injecting the drop of another slice flat surface, the process of specifying the above-mentioned scanning direction, and the process of carrying out print signal conversion on the conditions changed based on the above-mentioned specification.

[0108]A process is combined so that nonuniformity may be offset, even when there is nonuniformity of jetting properties, such as an ink jet nozzle of multi, according to this method, and manufacture of a uniform working plane is attained.

[0109](Example 1 of a solid thing manufacturing method) Drawing 9 thru/or drawing 11 are the explanatory views of the 1st example of the solid thing manufacturing method by this invention. It is a figure in which drawing 9 shows process drawing, drawing 10 shows the sectional view of a solid thing, and drawing 11 shows the example of ink jet nozzle arrangement.

[0110]By the way, although this invention uses the art which injects unhardened ultraviolet-curing-resin liquid drop-like according to a control signal, its ink jet print method is publicly known as what performs formation of a drop, and injection control. Therefore, although the drip injection means in this invention shall be called an ink jet head on account of explanation and an injection tip shall be expressed as a nozzle or an orifice, the drop injected in this invention is not ink.

[0111]Injecting resin liquid etc. in this invention may call the above-mentioned process a print on explanation, although it is not for printing.

[0112]In process drawing shown in drawing 9, 110 shows the solid thing in which a print signal converting process and 112 were manufactured for a fault figure creation process and 111, and a UV irradiation process and 114 were manufactured for an ultraviolet-curing-resin liquid injection process and 113.

[0113]When the design of a solid thing is performed by a CAD system, it is made to output a sectional view as a sectional view from a CAD system. In reproducing from the information which measured the solid thing as shown in a map, a contour map shows sectional shape.

[0114]When the example which manufactures a hemispherical solid as the numerals 115 attached and shown in drawing 10 at (a) is taken now, you will make this into the pattern sliced in layers to the height direction, you will make it pile up this pattern of each other's one by one, and a solid will be manufactured.

[0115]The sectional view of 115A, 115B, and 115C is shown in (b), (c), and (d) as the typical layer. And each section advances the sectional view creation process 10 so that the direction shown as the dotted line and the solid line may be sent out in the form of the raster section signal made into a scanning direction.

[0116]As the numerals 116 are given to drawing 11 and the ink jet head to be used is shown in it, it is considered as the ink jet head of a multi-nozzle. 117 is an orifice opening of the ink jet head 116 of a multi-nozzle, and injects ultraviolet-curing-resin liquid in synchronization from each orifice opening.

[0117]It is the print signal conversion circuit 111 which is changed so that the signal which took up from the above-mentioned raster section signal may be parallel sent out to an ink jet head to compensate for arrangement of such an orifice.

[0118]In drawing 11, make X into a scanning direction, make Y into a vertical scanning direction, and the orifice 17 to a scanning direction For example, pitch P_x . Arranged by pitch P_y in a vertical scanning direction, pitch P_y is equal to the vertical scanning direction pitch of a raster section signal, and pitch P_x presupposes that it is n times the pixel signal pitch of a scanning direction.

[0119]On the memory space which is such an arrangement configuration and in which the raster section signal was accommodated in order to have carried out orifice signal distribution, the address corresponding to an orifice position is specified, a signal is taken up, and it takes out parallel, and changes into a drive signal. And ultraviolet curing resin is injected to a drop receptacle side by impressing this drive signal to the ink jet head 116 in the following ultraviolet-curing-resin injection process.

[0120]It is parallel to injection of the resin which forms one section, or an ultraviolet ray source is made to act after injection finishing, and the UV irradiation process 113 is performed. It is [high-pressure mercury-vapor lamp] usable in a light source.

[0121]Thus, after formation of one slice layer is completed, it returns to the process 110 again, the same process is repeated, and the following stratification is performed. And an end of formation of a whole cross section layer will obtain the solid thing 114.

[0122]As an ultraviolet-curing-resin formula, the following is applicable.

paints or color oligomer prepolymer : Adequate amount (good, even if there is nothing) sensitization material, such as an amino compound and ketone (E. -- A.) :2-50 (weight ratio) Acrylic urethane etc. : 20-50 (weight ratio) Reactive monomers (PETA, TMPTA, etc.) :10-20 (weight ratio) Additive agents (stabilizer, lubricant, etc.) :0.1-5 (weight ratio)

What is necessary is just to add according to the color required of the solid thing manufactured, and colorant, such as paints or a color, is not required for an essential target. An organic solvent etc. may be added, when obtaining a gel hardened material so that it may mention later.

[0123]By the way, the combination used for an ink jet head with the application of ultraviolet-curing-resin liquid is very convenient from a point of the prevention from blinding of an orifice. That is, since there is no dry solidification by natural neglect like the usual ink for a print, there is no blinding generating at the time of non-use.

[0124](Example 2 of a solid thing manufacturing method) By the ultraviolet-rays resin curing method using the conventional laser scan light of shape as shown below in Drawing 8, how to manufacture the solid thing which cannot be manufactured according to this invention is explained.

[0125]Drawing 12 (a) and (b) shows an example of the solid thing 109 made into the object of manufacture, (a) is a side view and (b) is a plan. And the bottom on which 106 is supported by the resin liquid drop receptacle side at the time of manufacture, and 107 and 108 are the bottom sides in a position higher than the above-mentioned bottom. In the solid thing manufacturing method of this invention explained in solid thing manufacturing method example 1, manufacture starts from the bottom 106, and manufacture can be advanced, accumulating on the bottom and laminating a solid thing in a possible upper space part. However, since a resin liquid drop cannot be received in the portion without the thing supported to the down side like 107,108 which floated in the air, this portion cannot be manufactured.

[0126]Then, in the manufacturing method of this invention, as shown in drawing 12 (c), in order to form the bottom which floated in the air, a resin liquid drop is received into a manufacturing process, and it is made to advance manufacture, making the buck 321 removable by a manufacture final process in synchronization with manufacture of a solid thing.

[0127]It is a figure for drawing 13 to explain process drawing of the above-mentioned solid thing manufacturing method example 2, and for drawing 14 explain a process concretely. In drawing 13, a slice top view creation process and 111 110 A print signal converting process, 112 shows the solid thing in which a buck pattern drawing creation process and 118 manufacture an ultraviolet-curing-resin liquid injection process and 117, a buck liquid injection process and 113 were manufactured for a print signal converting process and 119, and a buck removal process and 114 were manufactured for a UV irradiation process and 120.

[0128]The processes 110, 111, 112, and 113 are the same contents as the process explained by drawing 9. The process 117 is a process of creating the pattern drawing for the buck 321 based on a slice top view.

[0129]Drawing 14 is a figure explaining the slice top view for the solid thing 109 and the buck 321. When advancing manufacture of the solid thing 109 like drawing 12 (c), the pattern drawing made to correspond to the slice flat surface of S_1-S_1' and S_2-S_2' is shown in (a) - (d). (a) and (b) are the pattern drawings of the portion which forms the solid thing 109, and (c) and (d) are the pattern drawings for the buck 321.

[0130]Although what is necessary is just to have provided the buck pattern corresponding to the portion which needs support and the example by which the buck 321 is made from the example of a graphic display on the resin liquid drop receptacle side 320 was shown, it is, also when making the buck 321 on the solid thing 109 under manufacture and also laminating the solid thing 109 on it.

[0131]118 is the process of changing the pattern drawing of the above-mentioned buck 321 into a print signal, and is the same as that of the process 111. And 119 is the process of injecting the liquid which forms the buck 321. The process 112 of injecting ultraviolet-curing-resin liquid, and the

drip injection process 119 of forming the buck 321 are advanced almost in synchronization, and both processes complete them per each slice flat surface. After ending the process of UV irradiation 113, it returns to the pattern formation process of the following slice layer.

[0132]The raw material which forms the buck 321 needs to be able to remove. The method of injecting the liquid which distributed paints in the binder which can dissolve, making the buck 321, making a solvent acting by the final process 120, and removing the buck 321 may be used.

[0133]Using the ultraviolet curing resin which added the solvent, a gel hardened material is obtained by UV irradiation, and it is considered as the buck 321, and the solvent which dissolves a gel hardened material is made to act, and it is made remove the buck 321 by a gel hardened material, or to remove by the final process 120. In order to make a gel hardened material or an elasticity hardened material, the resin liquid in which the polymer of low molecular weight is generated by UV irradiation may be applied. It may be the method of making the buck 321 and the solid thing 109 disengageable by injecting ***** so that it may mention later.

[0134]It is or like [the drop which forms the buck 321 is an ordinary temperature solid, and] the wax which becomes liquefied at the time of an elevated temperature. In this case, the buck 321 is removed by heating or the solvent.

[0135]The thickness formed of one drip injection since the presentations of the liquid to apply differ in the formation process of the solid thing 109 and 321 copies of bucks, When it differs in the portions of 321 copies of bucks, and the solid thing 109, manufacture can be advanced normal by adding the amendment for adjustment of a thickness direction in a buck pattern drawing creation process.

[0136]Removal of the buck 321 in the final process 120 is as above-mentioned.

[0137]Thus, in the manufacturing method of drawing 13 and drawing 14, as for each ink jet head, since two kinds of different drops are injected in synchronization, what is unified and can form two sorts of drops is good.

[0138]Since the method which injects a release agent at the interface of the solid thing 109 in the solid thing preparation method explained in drawing 13 and drawing 14 differs in other methods and the contents of the process a little, it explains the process by drawing 15 and drawing 16.

[0139]It is a figure with which drawing 15 explains process drawing and drawing 16 explains the relation between the solid thing 109, buck 321', and the releasing layer 326, and drawing 17 (a) - (b) shows each pattern drawing.

[0140]Even if the solid thing 109 and buck 321' are the same presentations, they may be a different constituent, but it is more convenient to create them with the same ultraviolet curing resin in drawing 16 (a), in order to facilitate. And along both interface, the releasing layer 326 is applied in the shape of a thin layer, and is formed.

[0141]Thus, it manufactures, as drawing 16 explained, and the solid thing 109 is created by making the power which pulls apart between buck 321' and the solid things 109 act, and removing buck 321'.

[0142]In process drawing of drawing 15, 122 is [a release agent injection process and 120' of a releasing layer pattern drawing creation process, 111', and 124] buck removal processes a print signal converting process and 125 a hardened material pattern drawing creation process and 123.

[0143]Based on the slice top view made from the process 110, two pattern drawings for a manufacturing process are made. One is a hardened material pattern drawing made from the process 122, and this pattern constitutes a solid thing and a buck. Another is a releasing layer pattern drawing and constitutes the releasing layer 326 between the solid thing 109 and the boundary of buck 321'.

[0144]In drawing 17, (a) - (e) shows the example of each above-mentioned pattern drawing, and corresponds with the solid thing 109 of drawing 16. The section of S_1-S_1' and S_2-S_2' is the same cross section position as having been shown in drawing 12 (c), and the section of S_3-S_3' is a thing

of the position shown in drawing 16.

[0145]Drawing 17 (a) has left the portion in which a releasing layer enters among both in the pattern drawing of the hardened material in an S_1-S_1' section including the portions of a solid thing and a buck. Drawing 17 (b) is a hardened material pattern drawing of S_2-S_2' similarly.

[0146]Next, drawing 17 (c) is a pattern drawing of the releasing layer in an S_1-S_1' section, and drawing 17 (d) is a releasing layer pattern drawing of an S_2-S_2' section. And drawing 17 (e) shows S_3 and the releasing layer pattern drawing of the S_3' section.

[0147]111' and the print signal converting process of 124 are the same as the example of drawing 9 and drawing 13. And ultraviolet-curing-resin liquid is injected in the resin liquid injection process 112. A release agent is injected in the release agent injection process 25. Therefore, as for an ink jet head, what has two orifice groups preferably is good.

[0148]Waxes, silicone oil, SHIRIKORU resin liquid, fluorination resin liquid, etc. which were melted in the solvent as a release agent are applied.

[0149]Next, if the UV irradiation process 113 finishes, it will return to the process for the next slice layer formation. If a final stratum is stiffened, next buck 321' will be removed and creation of the solid thing 109 will finish.

[0150]In the all directions method explained above, the ink jet head to apply may be a thing of a multi-nozzle on demand type, and may be a KONTINIASU type thing of a single nozzle. The size of the drop of the resin liquid which is injected in any case, and making distribution density it being uniform and uniform are fairly accompanied by difficulty. For example, in the thing of the former multi-nozzle type, when producing nonuniformity in the disagreement etc. of the shape of the portion which gives the shape and injection energy of each nozzle and connecting one band-like injection field after another, nonuniformity is produced in the lap of the knot.

[0151]Also in the ink jet head of a continuous type, although mechanical scanning movement is carried out to horizontal scanning and vertical scanning, it is difficult to remove the delivery nonuniformity.

[0152]When there is such nonuniformity and the pattern of the nonuniformity forms each slice cut surface, it acts as it is, and the inconvenience which produces unevenness in the field which should be laminated by the flat arises.

[0153]In order to make it not based on highly precise-ization of an ink jet head and a scanning mechanism and to remove the obstacle of such nonuniformity, The process of carrying out scanning movement of a drop receptacle side and the ink jet head in the 1st direction, and injecting the drop for every slice flat surface, The process of rotating relatively a drop receptacle side and the scanning direction of an ink jet head in the direction other than the 1st direction of the above, and injecting the drop of another slice flat surface, It is effective if the method referred to as repeating periodically the process of specifying the above-mentioned scanning direction, and the process of carrying out print signal conversion on the conditions changed based on the above-mentioned specification is adopted.

[0154]Drawing 18 and drawing 19 are the figures for explaining the above-mentioned manufacturing method, and it is a figure with which the former explains process drawing and the latter explains the example of combination of a scanning direction, and the equalization effect of a field formed.

[0155]In drawing 18, each process of 110, 111, 112, and 113 is the same as the method explained by drawing 9. There is a point which carries out difference uniquely in changing rotating the direction of the scan in the process of injecting resin liquid, one by one.

[0156]Therefore, there is the scanning direction specification process 127 and the converting process and resin liquid injection process of a print signal are controlled by this. And change of the print direction is changed while moving from the process of UV irradiation to the formation process of the following layer, in order to change formation of each class as a unit.

[0157]Drawing 19 shows the example of a change. The example of a graphic display is an example which manufactures an elliptic cylindrical solid thing.

[0158]a-1 and a-2 show the time of formation of the bottom of the heap, and a-1 shows the direction [an ellipse] of the 1st to a scanning direction. a-2 shall show distribution of the nonuniformity of the drop at this time.

[0159]If injection is repeated and it goes by the posture of this as, nonuniformity will be piled up as it is and the absolute value of the difference of elevation in the case of making a flat surface will be expanded.

[0160]So, at the following stratification process, as shown in b-1, 90 degrees of direction of an ellipse to the direction of a scan are rotated. The situation of the layer piled up by this direction comes to be shown in b-2, and a concavo-convex absolute value does not increase.

[0161]If the following stratification rotates an ellipse as shown in c-1, the layer formed will serve as a direction which decreases nonuniformity as shown in c-2. And the height nonuniformity of the accumulated thickness does not increase by coming to show the following stratification in d-1 and d-2, and repeating rotation of a-d henceforth.

[0162]In order to perform such rotation, a conversion condition when forming a print signal from a slice top view must be changed for every hand of cut. That is, since the direction of a figure pattern is changed as shown in c-1 to d-1, it must change. Simultaneously with it, in the resin liquid injection process 112, an image reception area, i.e., a drop backing plate side, and the scanning direction of an ink jet head are rotated relatively. What is necessary is just to rotate a backing plate side most simply.

[0163]About division of an angle of rotation, it is made to correspond to the situation of nonuniformity and can set up arbitrarily. However, although the effect that a direction with much division decreases nonuniformity is large, since it will complicate, it is good [the operation at the time of print signal conversion] to optimize division from both balance.

[0164]As mentioned above, although the all directions method of solid thing manufacture was explained in detail, according to the above-mentioned solid thing manufacturing method examined by this invention, the solid thing manufacturing method which can be performed with a simple device by a simple process is acquired. The solid thing manufacturing method which can be operated with a little ultraviolet-curing-resin liquid near the volume of a solid thing can be provided. The method whose manufacture of the solid thing of shape which was not able to be manufactured by the conventional method is enabled is obtained.

[0165]The nonuniformity of the thickness of each class at the time of solid part manufacture is amended mutually, and the manufacturing method which obtains the solid thing of a flat result side is acquired.

[0166]

[Effect of the Invention]As explained above, this invention uses the ink-jet printer which carries out drawing printing of the resist image by injection of resist ink based on a picture signal, It is what performs resist pattern formation by giving the picture signal of the pattern which should be formed to this ink-jet printer, and carrying out print formation of the pattern of the resist tunic in the ink for resist on a processing substrate side, According to this method, with the drive signal created based on the information received in the form of the picture signal. With the resist ink which is injected from the ink jet print head controlled, and adheres on a substrate to be processed, since a resist pattern is directly formed on a substrate, From not needing the original edition for making a pattern expose, but exposure of a photograph and a developing process becoming completely unnecessary. Since the part and materials are also cheap, end, and do not have worries about an environmental problem, and it becomes economical also in respect of equipment or a production cost and also it is the composition on which drawing information is made to print, the resist pattern formation method which has the features, like resist pattern formation is very easy and there is is acquired.

[Translation done.]

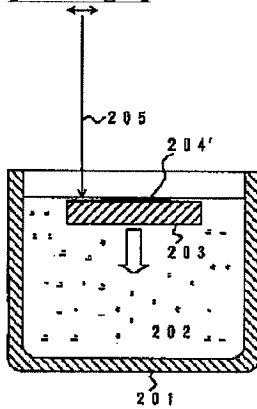
* NOTICES *

JPO and INPIT are not responsible for any damages caused by the use of this translation.

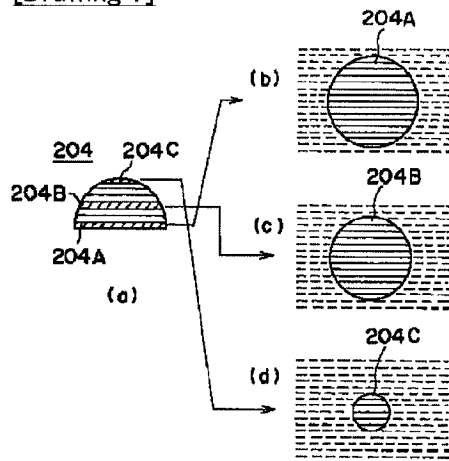
- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.*** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DRAWINGS

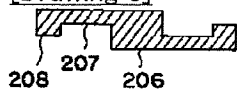
[Drawing 6]



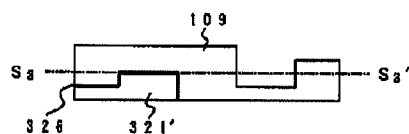
[Drawing 7]



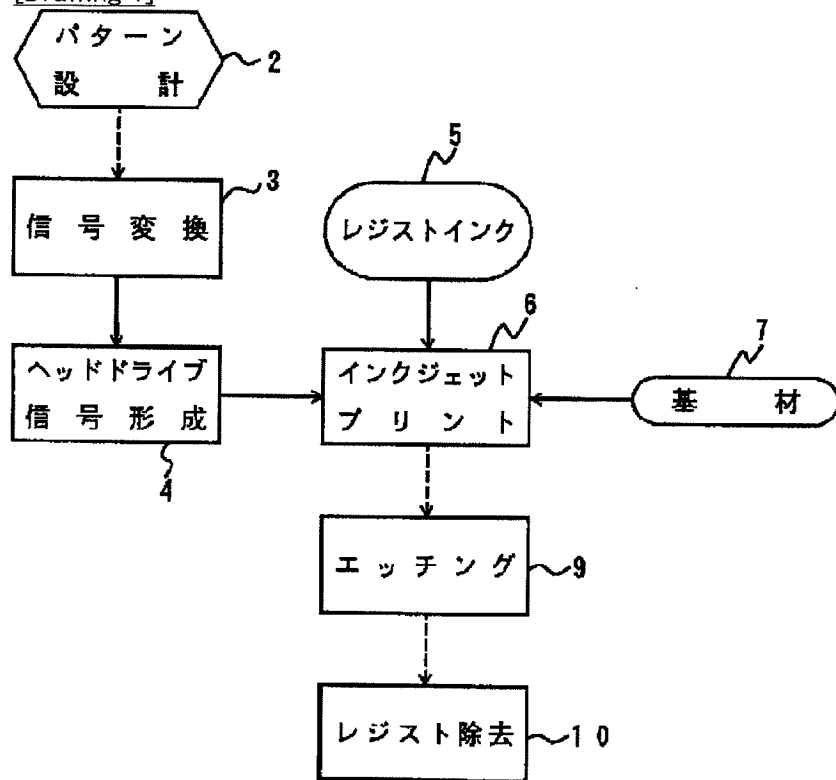
[Drawing 8]



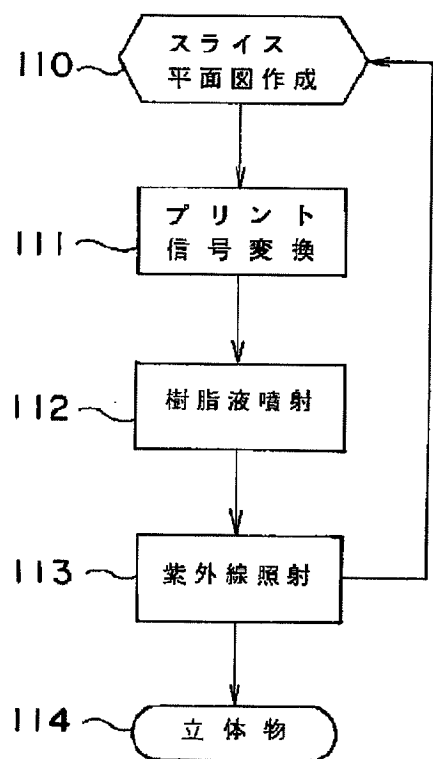
[Drawing 16]



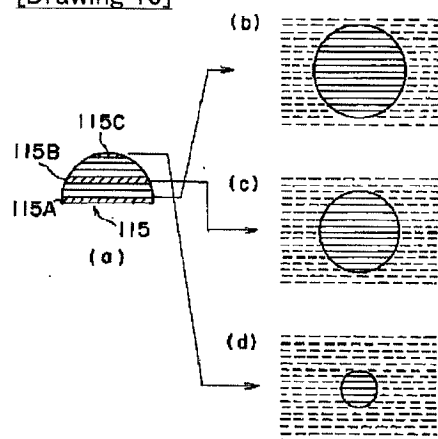
[Drawing 1]



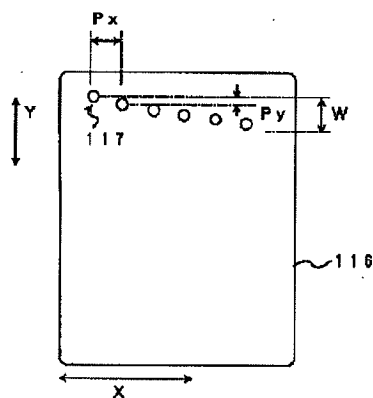
[Drawing 9]



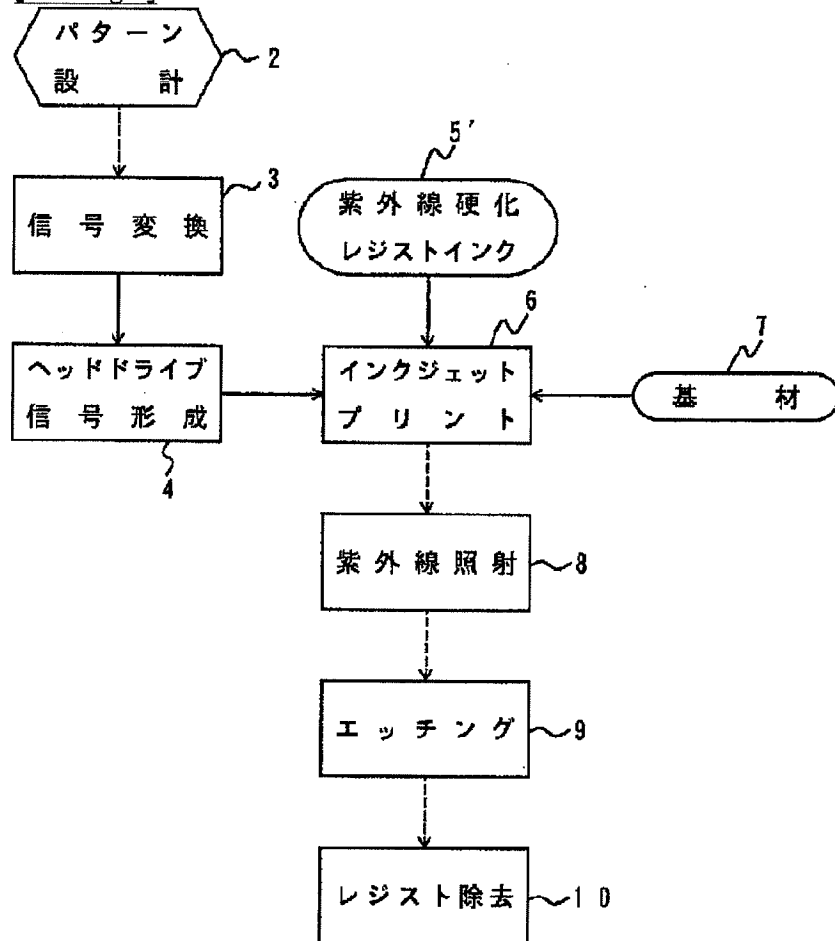
[Drawing 10]



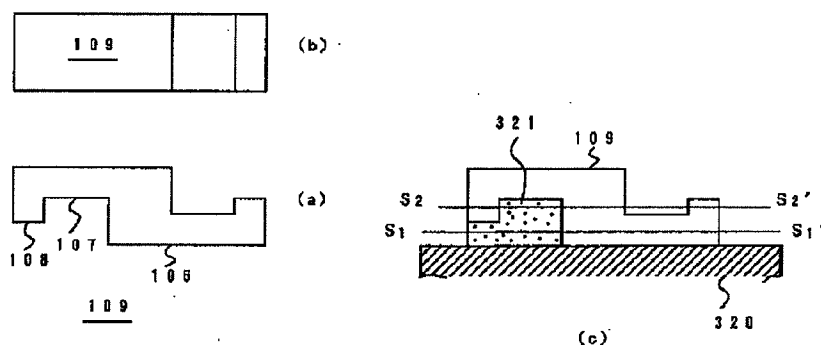
[Drawing 11]



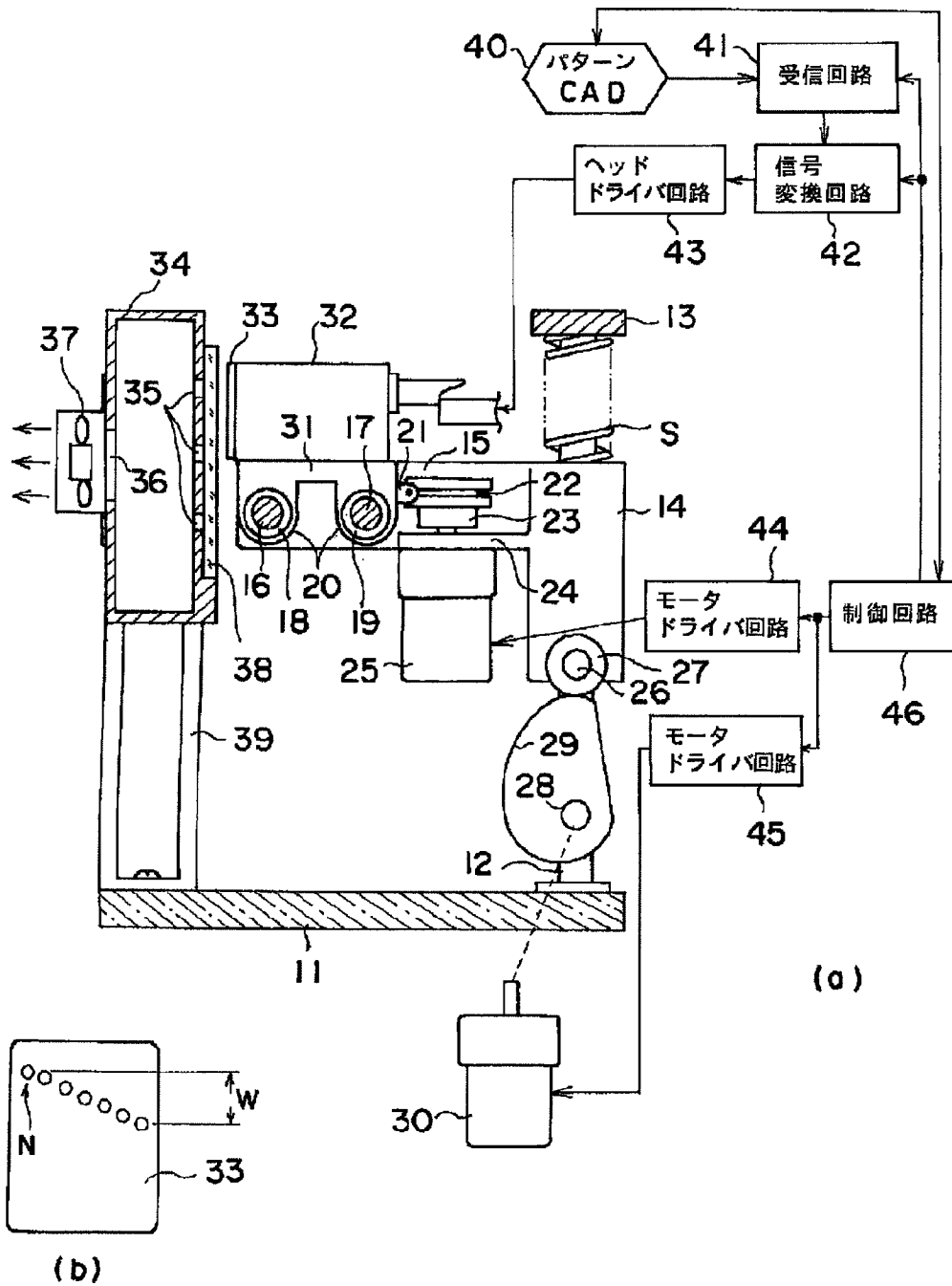
[Drawing 2]



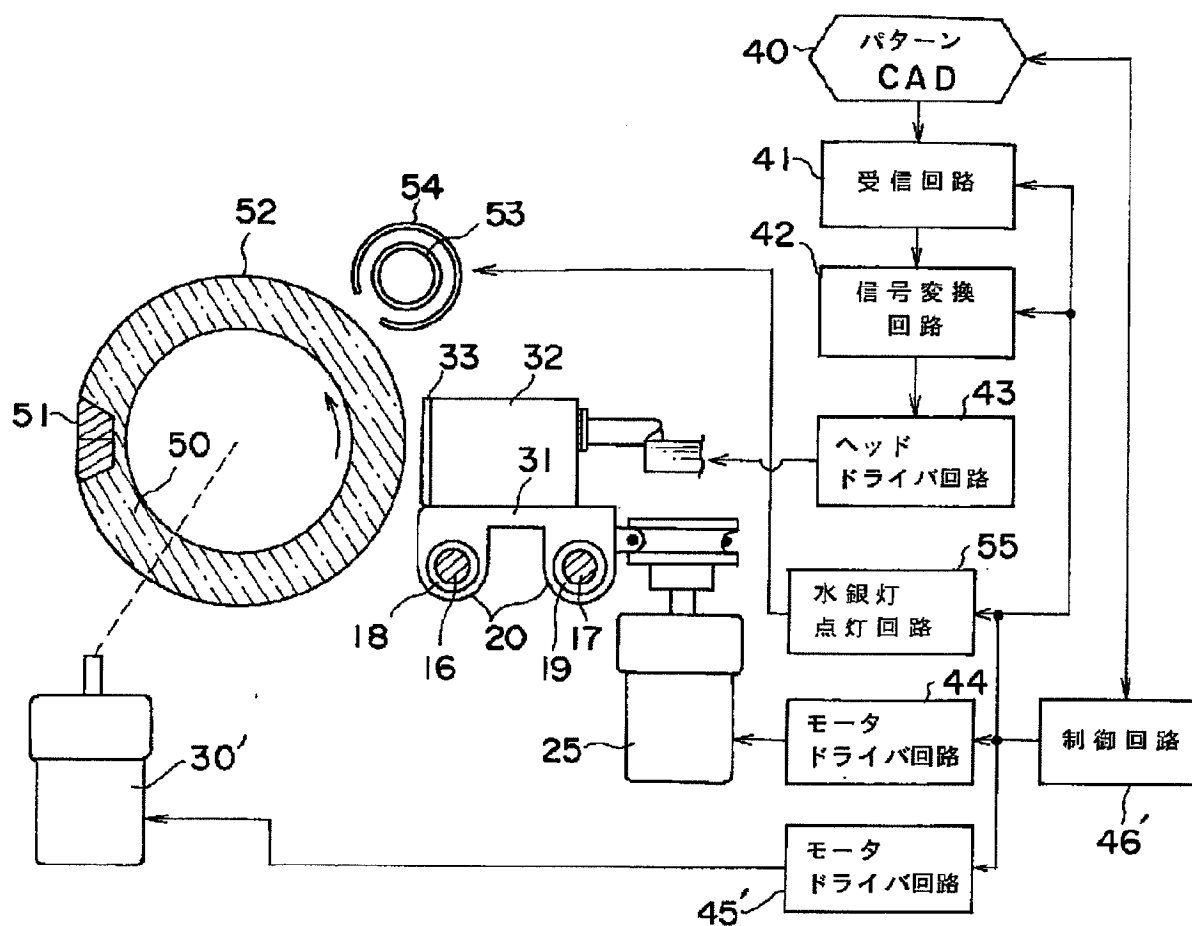
[Drawing 12]



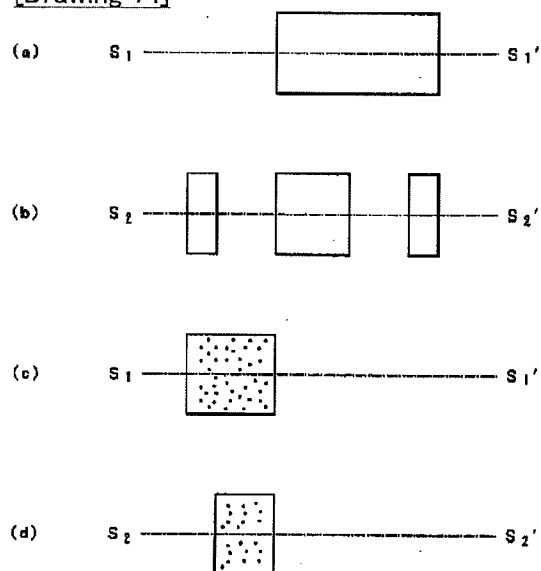
[Drawing 3]



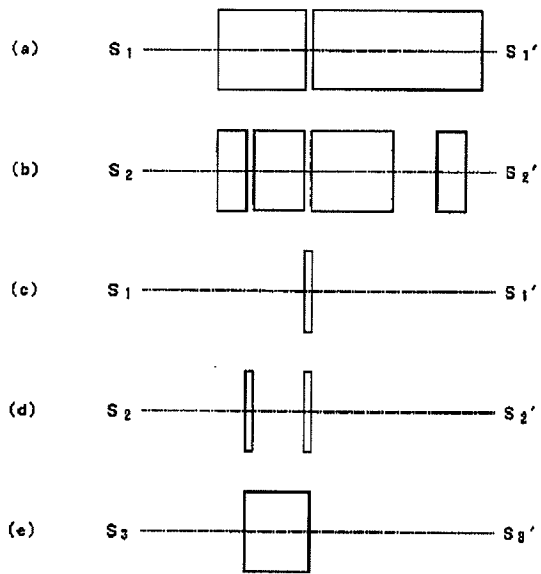
[Drawing 4]



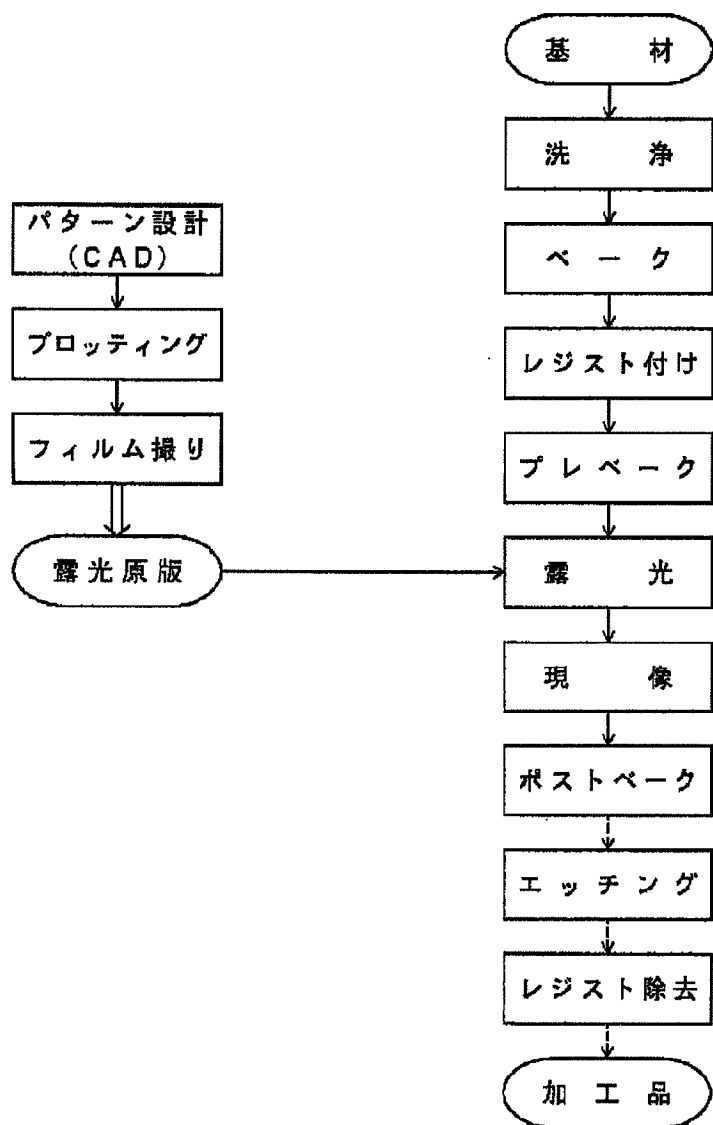
[Drawing 14]



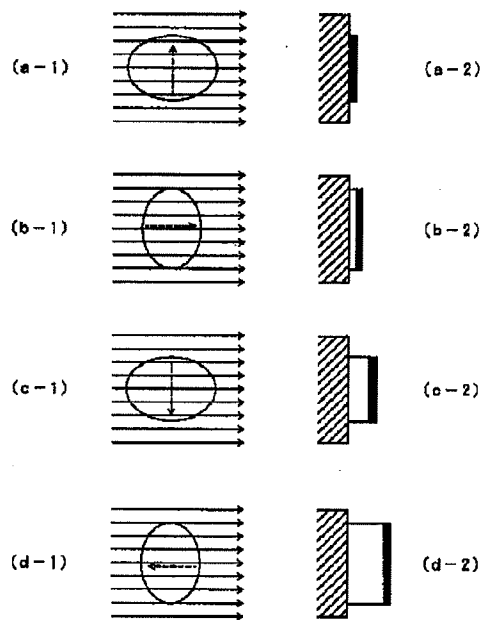
[Drawing 17]



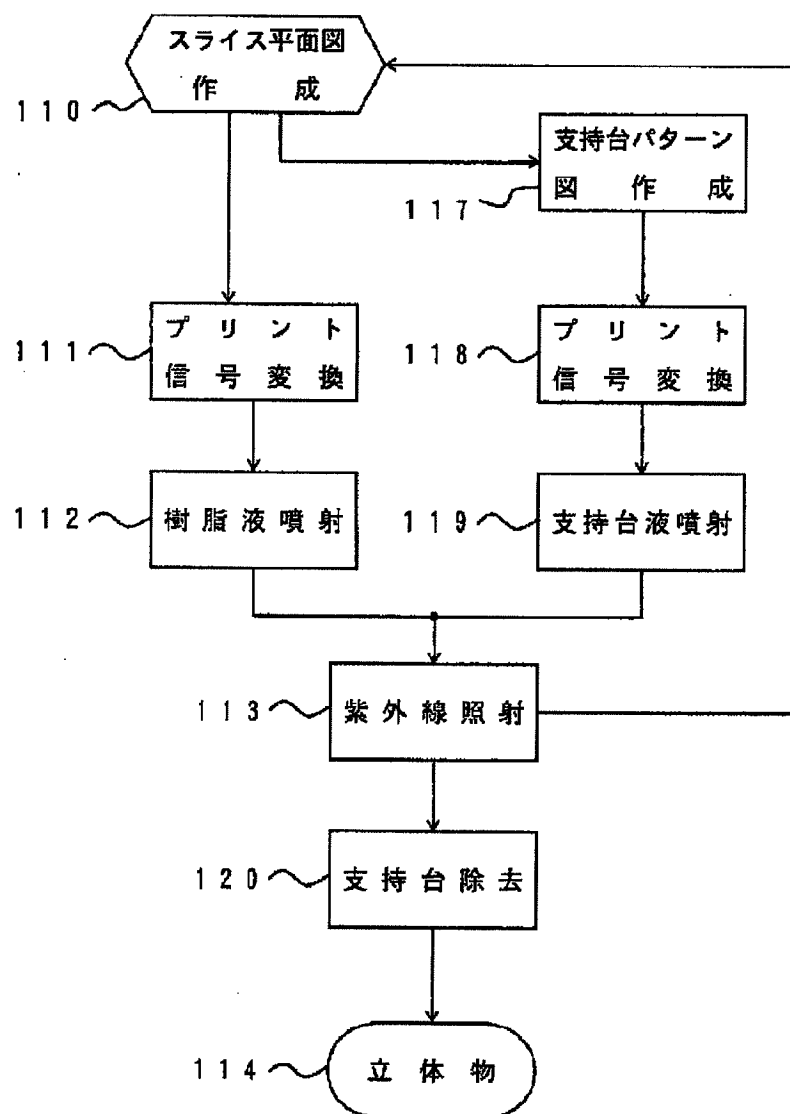
[Drawing 5]



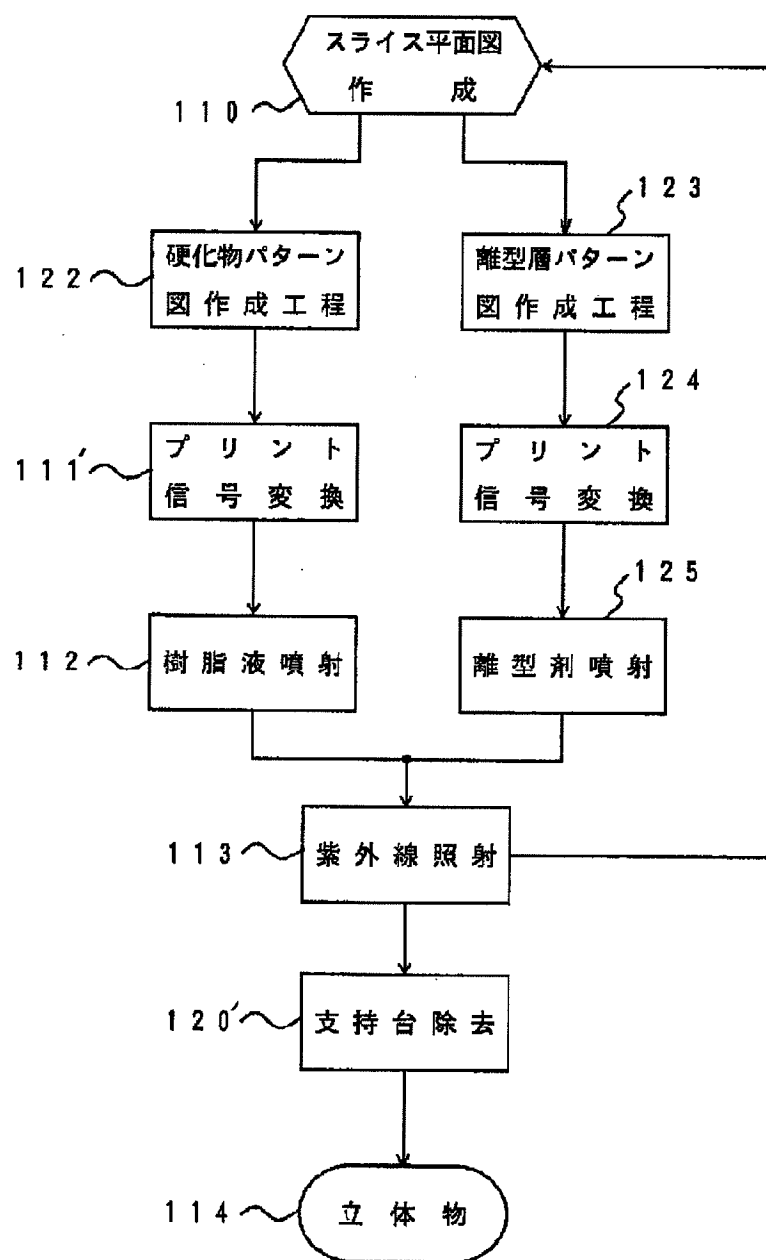
[Drawing 19]



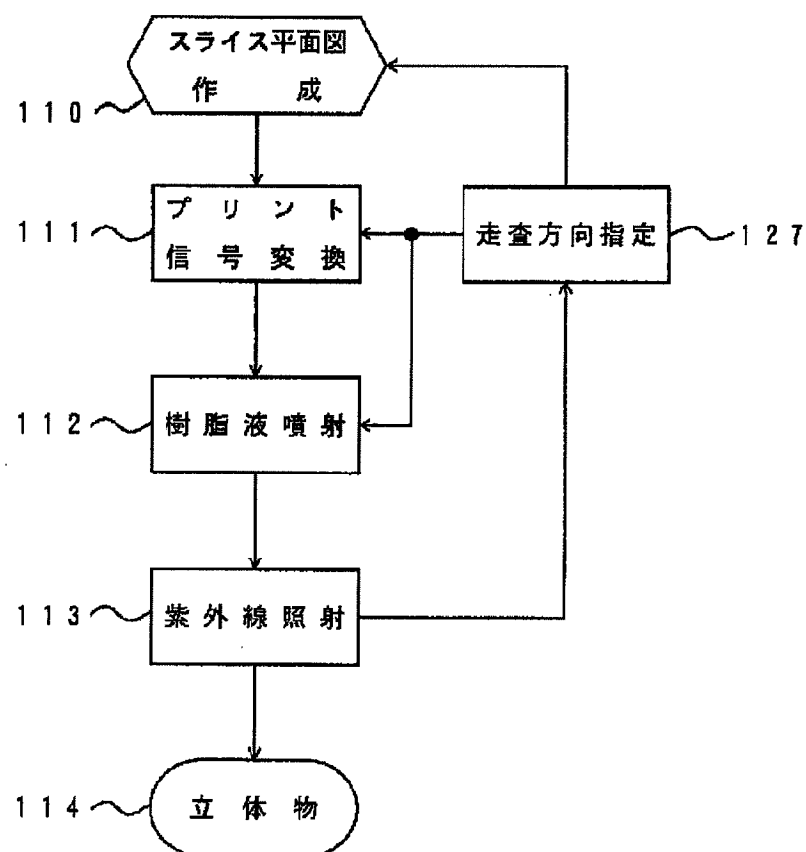
[Drawing 13]



[Drawing 15]



[Drawing 18]



[Translation done.]

Document 1)
(JP-A-5-338187)

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平5-338187

(43) 公開日 平成5年(1993)12月21日

(51) Int.Cl. ⁵	識別記号	序内整理番号	F I	技術表示箇所
B 4 1 J 2/16				
C 2 3 F 1/00	1 0 2	8414-4K		
H 0 5 K 3/06	E	6921-4E		
3/14	A	7511-4E		
		9012-2C		
			B 4 1 J 3/04	1 0 3 H
審査請求 未請求 請求項の数 1 (全 20 頁) 最終頁に続く				

(21) 出願番号 特願平4-152469

(22) 出願日 平成4年(1992)6月11日

(71) 出願人 000000376

オリンパス光学工業株式会社
東京都渋谷区幡ヶ谷2丁目43番2号

(72) 発明者 西川 正治

東京都渋谷区幡ヶ谷2丁目43番2号 オリ
ンパス光学工業株式会社内

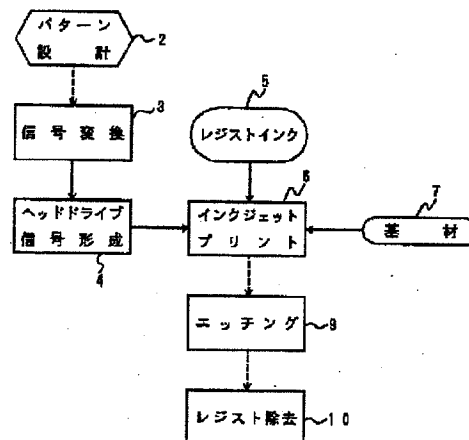
(74) 代理人 弁理士 鈴江 武彦

(54) 【発明の名称】 レジストパターン形成方法

(57) 【要約】

【目的】 本発明の目的はレジストパターン形成が容易で、資材も安価で済み、環境問題の心配もなく、設備や生産コストの点でも経済的なレジストパターン形成方法を提供することにある。

【構成】 被加工基材7の表面に所望パターンのレジスト被膜を形成し、レジスト被膜の有無による表面の性質の差に基づいて、レジスト被膜の無い部分に変化を生ぜしめる後加工の工程に適用するための上記レジスト被膜のパターン形成方法において、画信号に基づいてインク噴射により像を描画印刷するインクジェットプリンタ6を用い、このインクジェットプリンタのインクとしてレジスト用インク5を使用すると共に、形成すべきパターンの画信号をこのインクジェットプリンタに与えて被加工基材面上にレジスト用インクによるレジスト被膜のパターンを印刷形成する。



【特許請求の範囲】

【請求項1】 被加工基材の表面に所望パターンレジスト被膜を形成し、レジスト被膜の有無による表面の性質の差に基づいて、レジスト被膜の無い部分に変化を生ぜしめる後加工の工程に適用するための上記レジスト被膜のパターン形成方法において、

画信号に基づいてインク噴射により像を描画印刷するインクジェットプリンタを用い、このインクジェットプリンタのインクとしてレジスト用インクを使用すると共に、形成すべきパターンの画信号をこのインクジェットプリンタに与えて被加工基材面上にレジスト用インクによるレジスト被膜のパターンを印刷形成することを特徴とするレジストパターン形成方法。

【発明の詳細な説明】

【0001】

【産業上の利用分野】 本発明は、被加工基材の面上にレジスト被膜によるパターンを形成する工程と上記面上のパターンの有無に基づいて、パターンの無い部分に加工変化を生ぜしめ、パターン部分を加工作用から防護しながら加工を進める工程とから成るレジストパターンを用いた加工法に適用されるレジストパターンの形成方法及び形成装置に関するものである。

【0002】

【従来の技術】 被加工基材の面上にレジスト被膜によるパターンを形成し、上記面上のパターンの有無に基づいて、パターンの無い部分に加工変化を生ぜしめ、パターン部分を加工作用から防護しながら加工を進めるようにした加工法がある。

【0003】 このような加工法の応用分野としては、パターン状のエッチング、パターン状のメッキ、パターン状の蒸着、パターン状の電解酸化等が公知であり、広く実用に供されている。

【0004】 図5は公知のエッチング加工法の工程を示す図である。

【0005】 図に基づいてエッチング加工法を説明すると、各種金属、ポリイミド等のエッチング液によって溶解可能な基材が用意され、この基材に対し、先ず初めに脱脂等のための洗浄処理を行う。次いで吸着水分を除去するためのベークを行う。

【0006】 次にレジスト付けを行うが、このレジスト付けの工程では液状のレジスト液を塗布するか、または予め膜状に加工されたレジスト膜を圧着する。そして、プレバーク工程ではレジストの溶媒を蒸発させて除去する。

【0007】 他方、エッチングするためのパターンはCAD（計算機支援設計）等を用いて設計され、この設計されたパターンはカッティング・プロッタやフォト・プロッタによってプロットアウトされてパターンチェックされる。

【0008】 この段階では通常加工されるパターンより

も大きな拡大率でプロットアウトされている。プロットアウトされたパターンは、次にカメラでフィルム撮影し、この撮影したフィルムを現像してフィルム化する。

【0009】 このようにして得られたフィルムが露光用の原版である。

【0010】 次に基材の表面に対してレジスト付けを行い、プレバークする。次にこのプレバークした基材の表面上に上記露光用原版を重ね合わせて、原版の上から紫外線露光を行う。上記露光用原版におけるパターンは、エッチングで残したい部分が透明で、除去したい部分が黒くなるようにしておく。

【0011】 露光用原版を介して紫外線露光を行うと、基材上のレジストは、パターンの透明部分に位置する部分が紫外線で重合、硬化することになる。従って、レジストが紫外線で重合、硬化すると露光終了である。露光後、未硬化のレジスト材を除去するための現像工程処理を行い、ポストバークによって現像液やリンス液を蒸発させると共に、硬化部分の接着力を熱で高めてレジストパターン形成の工程を終了する。

【0012】 このようにしてレジストのパターニングを終えるとエッチング工程に移る。

【0013】 基材のエッチング工程においては塩化第2鉄、塩化第2銅等の金属を化学的に溶解する液をパターンニングした面に作用させて、基材のレジストパターンの無い部分の金属を除去する。そして、最終の工程で不要となったレジスト膜を剥離または酸化して除去し、全工程を終了する。

【0014】 エッチング以外の加工法であって、レジストパターンを利用するものにおいても、レジストパターン形成までの工程は同様なものとなる。

【0015】 なお、上記レジストパターン形成工程において使用される装置は洗浄槽、ベーク炉、レジスト塗布機または圧着機、紫外線露光装置、レジスト現像機、CAD、カッティングプロッタまたはフォトプロッタ、大型カメラ、フィルム現像機一式、排水処理装置等である。また、資材としては洗浄液、レジスト材、カッティングフィルム、写真フィルム、写真現像液一式、排水処理剤等が用いられる。

【0016】

【発明が解決しようとする課題】 ところでこのような従来のレジストパターン形成方法は工程が複雑で、パターン形成までに長時間を要する。

【0017】 また、作業には専門的な知識や技能を持った人材を必要とする他、パターン形成のために高価な資材が消耗される。さらにまた、加工の工程で環境を汚染する恐れのある排液や廃棄物が発生することになり、また、加工のために高価な設備が多種必要となるばかりでなく、その設備の占有面積が大きいので設備投資が莫大なものとなり、更には設備の維持管理にの多大な費用がかかる。また、加工のために大量のエネルギーや水を消費

するなどの解決しなければならない多くの問題を抱えている。

【0018】従って、本発明の目的とするところは、レジストパターン形成が容易で、資材も安価で済み、環境問題の心配もなく、設備や生産コストの点でも経済的なレジストパターン形成方法を提供することにある。

【0019】

【課題を解決するための手段】上記目的を達成するため、本発明は次のようにした。すなわち、被加工基材の表面に所望パターンのレジスト被膜を形成し、レジスト被膜の有無による表面の性質の差に基づいて、レジスト被膜の無い部分に変化を生ぜしめる後加工の工程に適用するための上記レジスト被膜のパターン形成方法において、画信号に基づいてインク噴射により像を描画印刷するインクジェットプリンタを用い、このインクジェットプリンタのインクとしてレジスト用インクを使用すると共に、形成すべきパターンの画信号をこのインクジェットプリンタに与えて被加工基材面上にレジスト用インクによるレジスト被膜のパターンを印刷形成するようにした。

【0020】また、インクジェットプリントヘッドから、紫外線硬化レジスト用インクを噴射させてパターン形成するようにし、この形成された当該パターン上に紫外線を照射して硬化させるようにする。

【0021】

【作用】このように、本発明では画信号に基づいてレジストインクの噴射によりレジスト像を描画印刷するインクジェットプリンタを用いており、形成すべきパターンの画信号をこのインクジェットプリンタに与えて被加工基材面上にレジスト用インクによるレジスト被膜のパターンを印刷形成することによってレジストパターン形成を行う。

【0022】この方法によれば、画信号の形で受信された情報に基づいて作成されたドライブ信号によって、制御されるインクジェットプリントヘッドから噴射されて、被加工基材上に付着するレジストインクによって、直接的に基材上にレジストパターンが形成されるので、パターンを露光させるための原版を必要とせず、写真の露光、現像工程が全く不要となることから、その分、資材も安価で済み、環境問題の心配もなく、設備や生産コストの点でも経済的となる他、画情報を直接プリントさせる構成であるから、レジストパターン形成が極めて容易であるなどの特徴を有するレジストパターン形成方法となる。

【0023】また紫外線硬化レジスト用インクを用い、印刷後のパターン上に紫外線を照射して硬化させるようにすることで、被加工基材上にプリントされたインクは、紫外線によって重合硬化して、強固な被膜となると共に基材上に強固に付着するようになる。

【0024】

【実施例】以下、本発明の一実施例について、図面を参照して説明する。

【0025】(方法の実施例1)図1は本発明によるレジストパターン形成方法の工程を示す図である。図に示すように、本発明によるレジストパターン形成の工程は、初めにパターン設計を行うパターン設計工程2を実施し、必要とするレジストパターンの設計を行う。次に信号変換工程3を実施し、この設計したパターンを印刷するための信号に変換する。そして、この印刷するための信号をプリンタのドライブ信号に変換するプリントヘッド・ドライブ信号形成工程4を実施し、この工程において形成されたプリントヘッド・ドライブ信号に従ってプリンタを駆動するインクジェットプリント工程6を実施する。

【0026】インクジェットプリント工程6ではレジストインク5を使用し、被加工基材7にレジストインク5によるレジストパターンをプリントする。その後、エッチング工程8に入り、被加工基材7をエッチングし、それが終了したならばレジスト除去工程9に入って用済みとなった被加工基材7上のレジストパターンを除去する。

【0027】以上のように、レジストパターンを被加工基材7上に形成するにあたり、本発明ではレジストパターンをインクジェットプリンタにより、印刷することで形成し、原版の作成や露光、現像の工程を無くした点に特徴がある。これにより、原版の作成や露光、現像の工程で必要としていた薬品や水の使用を排除し、省エネルギー化と省力化を図っている。

【0028】パターン設計工程2におけるパターン設計はレジストパターンの画像情報を信号(データ)として得ることが目的であるから、省力化と能率を考えるとCADシステムを用いて行われることが好ましいが、ハンドワークで作成した原図をイメージスキャナで読取り、画信号に変換してこれを画像情報として得るようにしても良い。

【0029】パターンの画像情報が電気信号に変換されて供給されるのが本発明の工程のスタートとなる。受信された信号は信号変換工程3において、インクジェットプリントヘッドを制御するに適した組合わせと順序に並べ換えられる。原信号がベクタ信号である場合には、まずベクタ・ラスタ変換を行い、ラスタ画信号を得る。

【0030】ラスタ画信号は次いでインクジェット・プリントヘッドのノズル配列や主副走査機構に関連して決まる信号列に変換する。例えばインクジェット・ノズルがマルチノズル構成で、各ノズルが同時に動作してインクを噴射する構成の場合、ノズル配列位置に対応して複数の画信号を同時進行的に次々に取出して、次のヘッドドライブ信号形成工程へ送り込む。この工程はプリントヘッドを直接駆動するための電圧、パルス幅の信号を形成する工程である。

【0031】次のインクジェット・プリント工程6がパターンニングの最終工程である。この工程では、インクジェット・プリント・インクとしてレジスト用インクが適用される。

【0032】レジスト用インクに要求される性質は、次に行われる加工工程の種類によって異なる。例えば、後工程がエッチングやエレクトロフォーミング、電解酸化等の水溶性の処理液を用いる工程であれば、まず第1にレジスト用インクは耐水性である必要があり、更には処理液の処方から耐酸、耐アルカリ性であることが要求されることもある。

【0033】従って、この場合に最適なインクとしては、油性のインクジェット・インクや、固型ワックスを熱溶解した状態で噴射させるジェットインクや、後に述べる紫外線硬化タイプのインク等である。

【0034】更にインクジェット・プリント工程6においては、受像面として被加工基材7を適用する。後工程がエッチングの場合、被加工基材としては銅、ニッケル、ステンレススチール等の各種の金属、あるいはポリイミド等のエッチング可能なプラスチックなどが適用される。

【0035】また、後工程がエレクトロフォーミングの場合は、金属板等の導電性基材が適用される。この場合、加工物を剥離し易いように金属表面に酸化物、クロメート、硫化物等の被膜を形成させることがある。

【0036】被加工基材上に付着したインクが硬化するとレジストパターン形成の全工程を終了する。

【0037】図1には後工程の例として、エッチング及びレジスト除去の工程を図示した。しかし、他の加工法の場合にはこれと異なった工程となる。

【0038】被加工基材7として金属板を用い、エッチング加工を行う場合には、塩化第2鉄、塩化第2銅等の腐食液の中にレジストパターンを形成した基材を浸したり、腐食液をシャワー状に注ぎかけてエッチングを進める。これにより、レジストパターンの無い部分の金属は腐食除去されるが、レジストパターンの下の金属はそのまま残る。その結果、レジストパターンの形状通りの加*

*工ができる。

【0039】レジストパターンはエッチングされずに残ることから、最後にこれを除去するためにレジスト除去工程10に入る。エッチングの後にレジストパターンが残っていても良い用途もあるので、その場合はレジスト除去工程は省略することになるが、通常はレジストパターンが邪魔になるために除去する。

【0040】レジストパターンの除去は、アルカリ性の液等でレジスト膜を軟化させておき、そこへジェット水流やブラッシング等の外力を加えることで除去するが、レジストパターンが極く薄い膜の場合にはプラズマエッチングで除去することもできる。

【0041】ところで本発明の特徴はインクジェット・プリントヘッドによって、レジストパターンを基材上に直接、プリントすることでレジストパターンを形成することであるが、インクジェット・プリントヘッドによって基材上に付着させるレジスト用インクとしては紫外線硬化レジストインクを用いるのが極めて好都合である。

【0042】例えば、紫外線硬化インクの場合、紫外線を照射しない限り、インクは固化しないから、インクの固化によるインクジェット・ノズルの目詰まりを防止する効果が得られる。

【0043】また、形成されたレジストパターンは紫外線の照射で堅固な膜となると共に基材との接着力も増し、後工程で使用するエッチング液や電解液等の処理液に対する耐久性が高まり、レジストパターンとしての機能が高まる。

【0044】(方法の実施例2) 図2はレジスト用インクとして紫外線硬化インクを用いた場合の工程図を示すものである。図1の例との相異点はレジスト用インクとして紫外線硬化レジストインク5をインクジェット・プリント工程に適用する点と、インクジェット・プリント工程の後に紫外線照射工程8を加えた点である。

【0045】紫外線硬化インクジェット・レジストインクの処方例を下記に示す。

顔料または染料	: 適当量 (なくとも可)
増感材 (アミノ化合物、ケトン類等)	: 2~15 (重量比)
オリゴマープレポリマー (E. A.、アクリルウレタン等)	: 20~50 (重量比)
反応性モノマー (PETA、TMPTA等)	: 10~20 (重量比)
添加剤 (安定剤、滑剤等)	: 0.1~5 (重量比)

着色剤については、本来レジストパターンは目視のためのものではないから必要としないが、パターンニングが正常に行われたか否かを目視判定するような場合に役に立つので、適量加えておいた方がよい。

【0046】また装飾用のエッチング加工において、レジストパターンは残したままとする用途もあるが、この場合にはレジストパターンに着色剤を意図的に加えて、

目視効果を高める場合もある。この場合のレジストインクは、紫外線硬化タイプでなくとも可能であるが、紫外線硬化タイプの方が膜の強度や接着性に勝っているのが好ましい。

【0047】次に紫外線硬化工程8であるが、この工程では高圧水銀灯等の紫外光源を用い、波長250nm~350nmの紫外光を作用させてプレポリマーを重合、

硬化させる。

【0048】(装置の実施例1)次に上述した本発明のレジストパターン形成方法を適用したレジストパターン形成装置について図3を参照して説明する。

【0049】図3(a)は本発明によるレジストパターン形成装置の構成図であり、図3(b)は本装置で使用するインクジェット・プリントヘッドのオリフィス板の正面図である。

【0050】図3(a)において、11はベースプレート、12はガイドポスト、13はガイドポスト梁、14は昇降台、15は昇降台アーム、16、17はスライドレール、18、19はスライドベアリング、20はベアリング受け、21はワイヤフック、22はワイヤ、23はワイヤプーリ、24はモータ受け板、25は主走査モータ、27はカムフォロア、26はカムフォロア軸、29はカム、28はカム軸、30は副走査モータ、31は移動走査台、32はインクジェットプリントヘッド、33はオリフィス板、34は吸引支持台、35は吸引口、36は排気口、37は排気ファン、38は被加工基材、39は支柱、40はパターンCAD、41は受信回路、42は信号変換回路、43はヘッドドライバ回路、44、45はモータドライバ回路、46は制御回路を示している。

【0051】上記ベースプレート11の上端一端側近傍に上記ガイドポスト12が2本、間隔を置いて直立して配置される。ガイドポスト12は棒状の部材であり、この一対のガイドポスト12の上端はガイドポスト梁13が掛け渡されることによって固定され、アーチ状の枠が形成される。

【0052】一対のガイドポスト12にはこのガイドポスト12に案内されて昇降する昇降台14がはめ込まれている。昇降台14のガイドポスト12と接する面はスライドベアリングがはめ込まれ、円滑な昇降ができるようになっている。

【0053】また、昇降台14には昇降台アーム15が水平方向に腕を伸ばして設けられ、このアームの先端側近傍には2本のスライドレール16、17が掛け渡されるように設けられる。

【0054】そして、このスライドレール16、17に移動走査台31が取り付けられるが、そのためにスライドベアリング18、19がベアリング受け20に嵌め込まれ、スライドレール16、17はスライドベアリング18、19を貫通させる。

【0055】移動走査台31にはワイヤフック21があって、ワイヤ22を固定している。ワイヤ22は主走査モータ25の軸に取り付けたワイヤプーリ23と、図示しない他方の昇降台アームに回転自在に取付けたワイヤプーリの間に掛け渡されていて、主走査モータ25が回転すると移動走査台31がスライドレール上を移動する構成となっている。

【0056】昇降台14にはカムフォロワ27が、軸26によって取付けられ、カム29が昇降台を支えるようになっている。そして昇降台14の上端側にはコイル状のスプリングSがあって昇降台14を下方へ付勢するようになっている。

【0057】カム29には軸28が固定して取付けられており、図示しないがベースプレート11に取付けた軸受けによってこの軸28は軸支されると共に、副走査モータ30の軸と連結する構造となっている。従って、副走査モータ30の回転がこの軸28を介してカム29に伝達される構成となっており、カム29の回転に伴い、カム29の辺部に接しているカムフォロワ27が昇降されて昇降台14を昇降駆動操作できる構成になっている。

【0058】移動走査台31にインクジェット・プリントヘッド32が搭載されている。そして、このインクジェット・プリントヘッド32にはレジスト用インクが用いられている。

【0059】インクジェット・プリントヘッド32のオリフィス板33は例えば正面から見ると図3(b)に示すように、複数のインクジェットノズルNが設けられている。インクジェットノズルNは二次元的に配置され、高さ位置が僅かずつ変えてあると共に各ノズルNは同時進行的にインクを噴射できるマルチノズル構造となっている。

【0060】主走査モータ25の回転をプーリによってワイヤ22に伝え、ワイヤ22が移動走査台31をスライドレール16、17に沿って移動させ、その間にインクジェット・プリントヘッド32を動作させると、幅Wの帯状の走査領域にレジストインクによるプリントが行われる。

【0061】また、副走査モータ30を回転させることにより、昇降台14を昇降させることができるが、その量は1回あたりWとなるようにしてある。

【0062】レジストパターンの印刷対象となる被加工基材38はインクジェット・プリントヘッド32に対向するようにベースプレート11上に取り付けられた吸引支持台34に支持させる。この吸引支持台34は箱状になっていて、背面側に排気口36が設けられ、排気口部には排気ファン37が取付けられている。箱状の吸引支持台34の表側には複数の吸引口35が設けられていて、排気ファン37を回転させると吸引口を35通って空気が支持台34の箱の中に吸込まれる。従ってその前面に被加工基材38を置くと、負圧によって保持される仕組みとなっている。

【0063】従って、レジストパターンの印刷対象となる被加工基材38を吸引支持台34に吸着保持させた上で、主走査モータ25を回転させ、その回転をプーリによってワイヤ22に伝え、移動走査台31をスライドレール16、17に沿って移動させつつ、画信号によりイ

ンクジェット・プリントヘッド32をプリント動作させると、幅Wの帯状の走査領域にレジストインクによるプリントが行われ、この主走査を終える毎に、副走査モータ30を回転させて、昇降台14をWだけシフトさせて再び移動走査台31を主走査方向に移動させると云った動作を繰り返すことで、帯状の走査領域を次々に拡大して、被加工基材38の全面へ走査領域を拡げて行くことができる。そして、画信号に従って、被加工基材38の全面にレジストパターンをプリントすることができる。

【0064】本装置によって被加工基材38上に形成させるパターンの情報は電気信号の形で供給される。パターンの情報を作成し、電気信号の形で出力するのがパターンCADシステム40であり、ここで説明するパターンCADシステム40はホスト側装置の一例である。

【0065】パターンCADシステム40からのパターン情報出力であるパターン信号は受信回路41で受信されるが、受信回路41にはインタフェース回路やバッファメモリが含まれている。受信回路41で受信された信号は信号変換回路42へ送り込まれる。パターン信号がベクタ信号であれば、この信号変換回路42ではラスタ信号に変換する。

【0066】また、この信号変換回路42では図3(b)で示したようなインクジェット・プリントヘッド32のオリフィス構成に基づいて、各オリフィスから同時進行的にインクを噴射させてパターン形成するための信号変換を行う。

【0067】変換された信号はドライバ回路43へ送り込まれて、各インクジェット・オリフィスエレメントを動作させるに適した電圧とパルス幅のドライブ信号に変換される。例えば、インクジェット・プリントヘッド32としてピエゾ素子を用いたプリントヘッドの場合、電圧約100V、パルス幅数百マイクロ秒(μs)の波形が典型的なドライブパルス波形である。

【0068】主副走査のためのモータ(パルスモータ、あるいはサーボモータ等)25を駆動制御するためのドライブ回路が44、45である。上述した主副走査移動と、パターン形成のためのインクジェット・プリントヘッド32の駆動とは連動させた制御が必要であり、そのための制御を行うことができるように制御回路46が設けられる。この制御回路46は同時にホスト側の装置40と本発明のレジストパターン形成装置間の相互の信号の流れと、動作制御を行うものでもある。

【0069】このような構成にすることでパターンを設計すれば、その設計内容に従ってインクジェット・プリントヘッド32を主および副走査させつつ、吸引支持台34上の被加工基材38表面にその設計したパターンのレジスト膜をプリントすることができる。

【0070】以上、図3の実施例においては、インクジェット・プリントヘッドを縦横両方向に移動(主および副走査)させるようにし、被加工基材は固定してレジス

トパターンを形成する構成を示した。

【0071】この構成の場合、パターン形成のための移動要素は全てプリントヘッド側で行っているために、被加工基材の形状や寸法等が変化しても、パターン形成が可能であり、適用範囲が広い特徴がある。

【0072】なお、これらの走査機構やインクジェット・プリントヘッドの構造、動作原理はこの例に限定されるものではない。また、フレキシブルプリント基板や、薄い金属板のような可撓性の薄いシート状の基材上にパターン形成する場合には、対をなす搬送ローラに2点を挟んで支持したり、両端を巻き取るなどして基材を移動させることで副走査送りとすることができる。また、次の実施例に示すようにドラム上に基材を支持させ、ドラムの回転を走査に用いることもできる。

【0073】インクジェット・プリントヘッドもオンデマンドタイプのマルチノズル構造のものに限定されず、コンティニuas方式のヘッドも適用可能である。

【0074】(装置の実施例2)レジストパターン形成に用いるレジストインクを紫外線硬化インクにすることの利点は先に説明した通りである。

【0075】ところで紫外線硬化インクを適用した場合には、インクジェットプリントヘッドによるパターン形成後に被加工基材を紫外線照射装置へ送り込んでインクを硬化させても良いが、本発明のレジストパターン形成装置内で、被加工基材の通路に面する位置に紫外線光源を配置しておけば、レジストパターン形成の全工程をこの装置によって終了させることができる。

【0076】図4はこのようなことを実現するための装置の実施例である。

【0077】図において、16から46までの符号を付した要素は図3における同符号の要素と同じである。そして、50は基材支持ドラム、51はグリップ、52は被加工基材、53は高圧水銀灯、54はランプカバー、55は水銀灯点灯回路をそれぞれ示している。

【0078】本実施例図においてはインクジェット・プリントヘッド32には紫外線硬化レジストインクが適用され、被加工基材の搬送路に面して紫外線光源が配置される。ドラム50はその周面上に被加工基材を支持するためのグリップ51を設けてあり、被加工基材をドラム50の周面に巻き付けた上で、被加工基材の端部をこのグリップ51で固定することにより、ドラム50の周面に被加工基材を保持させる構成としてある。

【0079】そしてドラム50を回転させるためのモータ30が設けられ、このモータ30によってドラム50を回転させることにより、被加工基材の副走査方向に走査させる。

【0080】このような構成により、被加工基材が金属薄板、フレキシブルプリント基板材料等の可撓性のシート状基材の場合、その先端及び後端をグリップ51によって保持させ、ドラム50上に密着保持させることがで

きる。

【0081】本装置の場合、インクジェット・プリントヘッド32はドラム50に対向して配置すると共に紫外線照射のための高圧水銀灯53をドラム50の周面に配設する。

【0082】インクジェット・プリントヘッド32は移動走査台31に載置され、スライドレール16、17上を主走査方向に移動し、帯状の領域にレジストインクを噴射する。また、インクジェット・プリントヘッド32の往復移動毎にドラム回転用のモータ30をドライバ回路45によって駆動制御して、上記帯状領域の幅W分だけドラム50を矢印方向に移動させ、次々にレジストインクの噴射領域を拡げる。

【0083】レジストインクによるパターンを形成した領域が高圧水銀灯53の紫外線照射領域に差し掛かると、パターン状に噴射されたレジストインクは重合、硬化して、レジスト膜として必要な強固な被膜に変化する。

【0084】このように被加工部材の移動と、プリントヘッドの移動を組合わせて主・副走査を行う構成にすれば、走査のための移動機構のスペースも少なく済み、また、移動のための機構も簡略化できる。

【0085】なお、図4構成において主走査をドラムの回転によって行い、プリントヘッドの移動で副走査を行うように変更することも当然可能である。このように、被加工部材を移動させて走査する構成は被加工部材がシート状でフレキシブルであり、しかも軽いものである場合には適用が容易である。

【0086】以上説明したように、本発明は被加工基材の表面に所望パターンのレジスト被膜を形成し、レジスト被膜の有無による表面の性質の差に基づいて、レジスト被膜の無い部分に変化を生ぜしめる後加工の工程に適用するための上記レジストパターン形成方法として、画信号に基づいてインク噴射により像を描画印刷するインクジェットプリンタを用い、このインクジェットプリンタのインクとしてレジスト用インクを使用すると共に、形成すべきパターンの画信号をこのインクジェットプリンタに与えて被加工基材面上にレジスト用インクによるレジスト被膜のパターンを印刷形成するようにしたことにより、パターン形成の工程が簡易で短時間で終了し、かつ特殊専門的知識や人手を要せずにレジストパターンが形成できるようになった。

【0087】またパターン形成のために消費される資材も少なく、環境を汚染するような排液や廃棄物の発生もない。また、パターン形成の装置も簡易、小形であって占有面積を少なく、消費するエネルギーや水等の資源も少なく済むと云った効果が得られる。

【0088】また、このような工程によるレジストパターン形成方法を実現する装置として、被加工基材を支持する手段と、レジスト用インクを適用したインクジェッ

トプリントヘッドと、被加工基材とインクジェットプリントヘッドを相対移動させて走査する手段と、レジストパターン画信号を受けて、プリントヘッドドライバー回路を動作させる信号を作り出す信号変換回路とからレジストパターン形成装置を構成した。これによって、上記方法が具体化できるようになる。

【0089】また、上記方法にさらに、被加工基材面上に、パターン画信号によって制御されたインクジェットプリントヘッドから、紫外線硬化レジスト用インクを噴射させてパターン形成する工程と、上記パターン上に紫外線を照射して硬化させる工程とを追加した。

【0090】これによれば、インクジェットノズルの目詰まりを防止して信頼性を高め、短時間に確実にレジストインクを硬化させることができ、しかも形成されたレジスト被膜の膜質が強固かつ基材との接着性を高める効果を生ずる。

【0091】また、このような工程によるレジストパターン形成方法を実現する装置として、被加工基材を支持する手段と、紫外線硬化レジスト用インクを適用したインクジェットプリントヘッドと、被加工基材とインクジェットプリントヘッドを相対移動させて走査する手段と、被加工基材の通路面に配置された紫外線光源と、レジストパターン画信号を受けて、プリントヘッドドライバー回路を動作させる信号を作り出す信号変換回路とからレジストパターン形成装置を構成した。これによって、上記方法が具体化できるようになる。

【0092】次に本発明を立体物製作に適用することについて検討したので、以下、これについて説明する。

(バックグラウンド) 日経メカニカル1991. 7. 8号 頁56～59に示されているように、CAD設計断面図や、地図の等高線図等の高さ方向にスライスされた断面図に基づいて立体物を製作することが知られている。

【0093】そして、その手法として例えば、各断面の単位厚さに対応する板材にパターン加工したものを積層する等の純機械的な製作方法がある。

【0094】また、機械的な手段を用いない製作法として紫外線硬化樹脂を、パターン信号で変調した紫外線レーザーによって走査してパターン状に硬化させ、この硬化層を次々に積層して立体物を作る方法が知られている。

【0095】図6は上記立体物製作方法を説明する図である。まず容器201の中に紫外線硬化樹脂202を入れる。容器201の中には加工物を支持する昇降台203を設ける。昇降台を樹脂液中に沈めて、わずかに薄い液層が昇降台面上に作られる様に昇降台を高さ調整する。そして薄い紫外線硬化樹脂液面へ断面図に基づいて変調した紫外線レーザービーム205を照射しながら二次元的に走査する。

【0096】紫外線照射を受けた部分は符号204を

付して示すように重合硬化した膜となる。製作される立体物を図7(a)の204とすると、立体は高さ方向に細分化した層構成として断面形状がインプットされる。その中の代表的な層204A、204B、204Cの断面図を各(b)、(c)、(d)に示す。

【0097】立体の形成は最下層から行われ、1層の硬化が終了すると、一旦昇降台を樹脂液面下に沈めてから再度所定の高さに戻す。そしてすでに形成した硬化膜の上に更に次の一層分の未硬化液膜を作り、この層へ向けて紫外線ビームを走査しながら走査露光する。このよう

な工程を繰り返すことによって硬化層は一層ずつ積み重なり、立体物が製作される。

【0098】(問題点)ところでこのような従来の紫外線硬化樹脂を用いた立体物の製作方法においては、製作される物に比べ、多量の未硬化紫外線硬化樹脂を用意しなければならず、また強力な紫外光ビームを得るための大型、高価なレーザ光源や、ビーム走査装置を必要とし、従って、装置の占有面積も大きく、コストが高く、大掛りな装置となってしまう。

【0099】また、底面から硬化層を順次積み重ねて行く方法であるから図8に示すような立体物の場合、底面206から順次積上げて支持可能な207のような領域は製作可能であるが、208のように下層または隣接部に支持すべき部分がない形状部分を製作することが出来ない。

【0100】これらの欠点を補い、簡易、小形な構成であって、使用する紫外線硬化樹脂量も少なくして製作可能な立体の形状の制約の少ない立体物製作方法を以下、説明する。

【0101】(実施例の概要)本発明においては、従来の立体物製作方法の欠点を解決するために、

[1]、高さ方向に細分化された層毎の断面形状を示すスライス平面図信号に基づいて立体物を製作する方法であって、立体物のスライス平面図を作成する工程と、スライス平面図信号をインクジェットヘッドを付勢する信号に変換するプリント信号変換工程と、上記信号に基づいて、インクジェットヘッドを付勢し、液滴受け面に向けて紫外線硬化樹脂液滴を噴射する工程と、液滴受け面上のパターン状の紫外線硬化樹脂液滴に向けて紫外線を照射する工程とを用い、上記各工程をスライス平面毎に繰り返して行い、順次積層することで解決した。

【0102】この立体物を製作方法によれば、小型、簡易な構成のインクジェットヘッド及び走査機構によって断面図の形で送り込まれた信号に従って噴射した紫外線硬化樹脂液に紫外線を照射して硬化させ、この工程を繰り返して立体物を製作するようにすることから、必要な樹脂量は立体物の体積をやや上回る最少量で済み、また、装置も安価で占有面積も小さくて済む。

【0103】[2]、また、[1]において、立体物の形状を示すスライス平面図に基づき、製作工程中に立体

物の一部を支持するための支持台の形状を示す支持台パターン図を作成する工程と、上記パターン図に基づき、他のインクジェットオリフィスを付勢する信号に変換するプリント信号変換工程と、上記信号に基づいて、立体物形成のための液滴噴射と併進させて、除去可能な支持台形成のための液滴を噴射する工程とを各スライス平面形成毎に加え、さらには全スライス平面の液滴噴射工程及び紫外線照射工程終了後に支持台を立体物から除去する工程を加えた。

【0104】この方法によれば、製作工程上必要な支持台を立体物と同時に製作し、最終的に支持部を除去して立体物だけを残すことができ、製作可能な立体物の形状の制約を大幅に緩和させることができる。

【0105】[3]、また、[1]において、立体物の形状を示すスライス平面図に基づき、立体物及び製作中に立体物の一部を支持するための支持台のパターン図を作成する工程と、上記立体物と支持台の境界面を示すパターン図作成工程と、立体物及び支持台パターン図に基づき紫外線硬化液滴を噴射する工程と、上記工程と併進させて境界面パターン図に基き離型剤液滴を噴射する工程と、全スライス平面の液滴噴射工程及び紫外線照射工程終了後に、支持台を立体物から除去する工程を加えた。

【0106】この方法によれば、製作工程上必要な支持台を立体物と同時に製作し、最終的に支持部を除去して立体物だけを残すことができ、製作可能な立体物の形状の制約を大幅に緩和させることができる。

【0107】[4]、更には第1の方向に液滴受け面とインクジェットヘッドを走査移動させてスライス平面毎の液滴を噴射する工程と、上記第1の方向とは別の方向に液滴受け面とインクジェットヘッドの走査方向を相対的に回転させて別のスライス平面の液滴を噴射する工程と、上記走査方向を指定する工程と、上記指定に基づいて変更した条件でプリント信号変換する工程とを周期的に繰り返すようにした。

【0108】この方法によればマルチのインクジェットノズル等の噴射特性のムラがあった場合でもムラが相殺されるように工程を組合わせ、均一な加工平面の製作が可能となる。

【0109】(立体物製作方法の実施例1)図9乃至図11は本発明による立体物製作方法の第1実施例の説明図である。図9は工程図、図10は立体物の断面図、図11はインクジェットノズル配置例を示す図である。

【0110】ところで本発明は未硬化紫外線硬化樹脂液を、制御信号に従って液滴状に噴射する技術を利用するが、液滴の形成や噴射制御を行うものとしてインクジェットプリント方法が公知である。従って、説明の都合上、本発明における液滴噴射手段をインクジェットヘッドと呼び、噴射口をノズルまたはオリフィスと表現するものとするが、本発明において噴射する液滴はインクではない。

【0111】また、本発明において樹脂等を噴射するのはプリントを行うためのものではないが、説明上、上記の工程をプリントと呼ぶ場合がある。

【0112】図9に示す工程図において、110は断面図作成工程、111はプリント信号変換工程、112は紫外線硬化樹脂液噴射工程、113は紫外線照射工程、114は製作された立体物を示している。

【0113】断面図は、立体物の設計がCADシステムで行われる場合には、CADシステムから断面図として出力するようにする。地図のように立体物を計測した情報から複製する場合には等高線図で断面形状を示すようにする。

【0114】今、図10において(a)に符号115を付して示すような半球状の立体を製作する例をとってみると、これを高さ方向に層状にスライスしたパターンとし、このパターンを順次重ね合わせて立体を製作することになる。

【0115】その代表的な層として115A、115B、115Cの断面図を(b)、(c)、(d)に示す。そして、各断面は点線及び実線で示した方向を主走査方向とするラスタ断面信号の形で送出するように断面図作成工程10を進める。

【0116】使用するインクジェットヘッドを例えば図11に符号116を付して示すように、マルチノズルのインクジェットヘッドとする。117はマルチノズルのインクジェットヘッド116のオリフィス開口であり、各オリフィス開口から同時進行的に紫外線硬化樹脂液を噴射するようにする。

顔料または染料	: 適当量 (なくとも可)
増感材 (アミノ化合物、ケトン類等)	: 2~50 (重量比)
オリゴマープレポリマー (E、A、アクリルウレタン等)	: 20~50 (重量比)
反応性モノマー (PETA、TMPTA等)	: 10~20 (重量比)
添加剤 (安定剤、滑剤等)	: 0.1~5 (重量比)

顔料または染料等の着色剤は製作される立体物に要求される色に応じて添加すれば良く、本質的に必要なものではない。また、後述するようにゲル状の硬化物を得る場合に有機溶剤等を添加する場合もある。

【0123】ところでインクジェットヘッドに紫外線硬化樹脂液を適用して使用する組合わせは、オリフィスの目詰まり防止の点からは極めて好都合である。すなわち、通常のプリント用インクのように自然放置による乾燥固化がないために不使用時の目詰まり発生がない。

【0124】(立体物製作方法の実施例2)次に第8図で示したような形状の、従来のレーザ走査光を用いた紫外線樹脂硬化法では製作不能である立体物を、本発明に従って製作する方法について説明する。

【0125】図12(a)(b)は製作の対象とする立体物109の一例を示し、(a)は側面図、(b)は上面図である。そして、106は製作時に樹脂液滴受け面

*【0117】このようなオリフィスの配置に合わせて、上記ラスタ断面信号からピックアップした信号をパレルにインクジェットヘッドに送出するように変換するのがプリント信号変換回路111である。

【0118】例えば図11において、Xを主走査方向、Yを副走査方向とし、オリフィス17が主走査方向にピッチ P_x 、副走査方向にピッチ P_y で配置され、ピッチ P_y はラスタ断面信号の副走査方向ピッチに等しく、ピッチ P_x は主走査方向の画素信号ピッチの n 倍であるとする。

【0119】このような配置構成のオリフィス信号分配するには、ラスタ断面信号を収容したメモリ空間上で、オリフィス位置に対応するアドレスを指定して信号をピックアップしてパレルに取出し、ドライブ信号に変換する。そしてこのドライブ信号を次の紫外線硬化樹脂噴射工程において、インクジェットヘッド116に印加することによって、紫外線硬化樹脂を液滴受け面へ噴射する。

【0120】ひとつの断面を形成する樹脂の噴射と平行して、あるいは噴射終了後に紫外線光源を作用させて紫外線照射工程113を行う。光源は高圧水銀灯等が使用可能である。

【0121】このように一つのスライス層の形成が終了すると、再び工程110へ戻って、同じ工程を繰り返し、次の層形成を行う。そして、全断面層の形成が終了すると立体物114が得られる。

【0122】紫外線硬化樹脂処方としては下記のようなものが適用可能である。

に支持される底面、107、108は上記底面より高い位置にある底側面である。立体物製作方法実施例1で説明した本発明の立体物製作方法では、底面106から製作がスタートして、その底面上に積上げ可能な上側空間部に立体物を積層しながら製作を進めることができる。ところが、107、108のように下側に支持する物がない、空中に浮いた部分では樹脂液滴を受けることができないので、この部分を製作することができない。

【0126】そこで本発明の製作方法においては、図12(c)に示すように空中に浮いた底面を形成するために、製作工程中に樹脂液滴を受け、製作最終工程で除去可能な支持台321を立体物の製作と同時に進行的に作りながら製作を進めるようにする。

【0127】図13は上記立体物製作方法実施例2の工程図、図14は工程を具体的に説明するための図である。図13において、110はスライス平面図作成工

程、111はプリント信号変換工程、112は紫外線硬化樹脂液噴射工程、117は支持台パターン図作成工程、118はプリント信号変換工程、119は支持台液噴射工程、113は紫外線照射工程、120は支持台除去工程、114は製作された立体物を示している。

【0128】工程110、111、112、113は図9で説明した工程と同じ内容である。工程117はスライス平面図に基き、支持台321のためのパターン図を作成する工程である。

【0129】図14は立体物109及び支持台321のためのスライス平面図について説明する図である。図12(c)のように立体物109の製作を進める場合に、 S_1-S_1' 、 S_2-S_2' のスライス平面に対応させたパターン図を(a)～(d)に示す。(a)、(b)は立体物109を形成する部分のパターン図で、(c)、(d)は支持台321のためのパターン図である。

【0130】支持台パターンは支持を必要とする部分に対応して設ければ良く、図示例では樹脂液滴受け面320上に支持台321が作られる例を示したが、製作中の立体物109上に支持台321を作り、更にその上に立体物109を積層するような場合もある。

【0131】118は上記支持台321のパターン図をプリント信号に変換する工程で、工程111と同様である。そして119は支持台321を形成する液を噴射する工程である。紫外線硬化樹脂液を噴射する工程112と支持台321を形成する液滴噴射工程119は、ほぼ同時進行的に進められ、各スライス平面単位で両工程が完了するようにする。紫外線照射113の工程を終了すると次のスライス層のパターン形成工程に戻る。

【0132】支持台321を形成する素材は除去可能であることが必要である。溶解可能なバインダ中に顔料を分散させた液を噴射して支持台321を作り、最終工程120で溶剤を作用させて支持台321を除去する方法でも良い。

【0133】溶剤を加えた紫外線硬化樹脂を用い、紫外線照射によってゲル状硬化物を得て支持台321とし、最終工程120でゲル状硬化物による支持台321を剥し取ったり、ゲル状硬化物を溶解する溶剤を作用させて除去するようにする。ゲル状硬化物あるいは軟性硬化物を作るために、紫外線照射によって低分子量の重合物が生成される樹脂液を適用しても良い。また、後述するように離形材を噴射することによって、支持台321と立体物109を分離可能とする方法であっても良い。

【0134】あるいは支持台321を形成する液滴は常温固体で、高温時に液状となるワックスのようなものであっても良い。この場合は加熱または溶剤によって支持台321は除去される。

【0135】立体物109及び支持台321部の形成工程において、適用する液の組成が異なるために1回の液

滴噴射によって形成される層厚が、支持台321部と立体物109の部分で異なる場合は、支持台パターン図作成工程において厚さ方向の調整のための補正を加えることによって、異常なく製作を進めることができる。

【0136】最終工程120における支持台321の除去は前述の通りである。

【0137】このように図13、図14の製作方法においては、2種類の異なった液滴が同時進行的に噴射されるので、各インクジェットヘッドは一体化されて2種の液滴を形成し得るものが良い。

【0138】図13、図14において説明した立体物作成方法の中で、離型剤を立体物109の境界面に噴射する方式は、その他の方式と工程の内容がやや異なるので、図15、図16により、その工程を説明する。

【0139】図15は工程図、図16は立体物109、支持台321及び離型層326の関係を説明する図であり、図17(a)～(b)は各パターン図を示している。

【0140】図16(a)において、立体物109及び支持台321は同一組成であっても、異なった組成物であっても良いが、簡便化するためには同一の紫外線硬化樹脂で作成した方が好都合である。そして、離型層326は両者の境界面に沿って薄層状に塗布されて形成されている。

【0141】このように図16で説明したように製作し、支持台321と立体物109の間を引き離す力を作用させて支持台321を除去することによって立体物109を作成するものである。

【0142】図15の工程図において、122は硬化物パターン図作成工程、123は離型層パターン図作成工程、111、124はプリント信号変換工程、125は離型剤噴射工程、120は支持台除去工程である。

【0143】工程110で作られるスライス平面図に基づき、製作工程のための二つのパターン図が作られる。一つは工程122で作られる硬化物パターン図で、このパターンは立体物と支持台を構成するものである。もう一つは離型層パターン図で、立体物109と支持台321の境界の間の離型層326を構成する。

【0144】図17において、(a)～(e)は上記各パターン図の例を示すもので、図16の立体物109と対応している。 S_1-S_1' 、 S_2-S_2' の断面は図12(c)に示したのと同じ断面位置で、 S_3-S_3' の断面は図16に示す位置のものである。

【0145】図17(a)は S_1-S_1' 断面における硬化物のパターン図で立体物と支持台の部分を含み、両者の間に離型層の入る部分を残している。同様に図17(b)は S_2-S_2' の硬化物パターン図である。

【0146】次に図17(c)は S_1-S_1' 断面に於ける離型層のパターン図であり、図17(d)は S_2-S_2' 断面の離型層パターン図である。そして、図17

(e)はS₃、S₃断面の離型層パターン図を示している。

【0147】111、124のプリント信号変換工程は、図9、図13の例と同じである。そして樹脂液噴射工程112において、紫外線硬化樹脂液が噴射される。また、離型剤噴射工程25においては離型剤が噴射される。従って、インクジェットヘッドは好ましくは二つのオリフィス群を有するものが良い。

【0148】離型剤としては溶剤に溶かしたワックス類、シリコンオイル、シリコール樹脂液、フッ素化樹脂液等が適用される。

【0149】次に紫外線照射工程113が終了、次のスライス層形成のための工程に戻る。最終層を硬化させると、次に支持台321を除去して立体物109の作成が終る。

【0150】以上説明した各方法において、適用するインクジェットヘッドは、マルチノズルのオンディマンド型のものであっても良く、またシングルノズルのコンティニアス型のものであっても良い。いずれの場合でも噴射される樹脂液の液滴の大きさや、分布密度をムラなく一様にするには相当に困難を伴う。例えば、前者のマルチノズルタイプのものでは各ノズルの形状や噴射エネルギーを付与する部分の形状の不一致等でムラを生じ、また、帯状の噴射領域を次々に繋ぎ合わせる時にその繋ぎ目の重なりによりムラを生ずる。

【0151】コンティニアスタイプのインクジェットヘッドにおいても、主走査・副走査にメカニカルな走査移動を行うが、その送りムラを除去することは困難である。

【0152】このようなムラがあって、そのムラのパターンが各スライス面を形成する時にそのまま作用して、フラットに積層されるべき面に凹凸を生じてしまう不都合が生ずる。

【0153】インクジェットヘッド及び走査メカニズムの高精度化によらずしてこのようなムラの障害を除くためには、第1の方向に液滴受け面とインクジェットヘッドを走査移動させてスライス平面毎に液滴を噴射する工程と、上記第1の方向とは別の方向に液滴受け面とインクジェットヘッドの走査方向を相対的に回転させて別のスライス平面の液滴を噴射する工程と、上記走査方向を指定する工程と、上記指定に基づいて変更した条件でプリント信号変換する工程とを周期的に繰り返すと云った方法を採用すると有効である。

【0154】図18、図19は上記製作方法を説明するための図で、前者は工程図、後者は走査方向の組み合わせ例及び形成される面の均一化効果を説明する図である。

【0155】図18において、110、111、112、113の各工程は、図9で説明した方法と同じである。唯一相異なる点は、樹脂液を噴射する工程における走査の方向を順次回転させながら変更することにある。

【0156】そのために走査方向指定工程127があって、これによってプリント信号の変換工程及び樹脂液噴射工程が制御される。そしてプリント方向の変更は各層の形成を単位として切替えるために紫外線照射の工程から次の層の形成工程へ移る間に切替えられる。

【0157】図19はその切替例を示すものである。図示例は楕円柱状の立体物を製作する例である。

【0158】a-1、a-2は最下層の形成時を示し、a-1は走査方向に対する楕円の第1の向きを示す。また、a-2はこの時の液滴のムラの分布を示すものとする。

【0159】このままの姿勢で噴射を繰り返して行くと、ムラがそのまま積重なって、平面を作る場合の高低差の絶対値を拡大してしまう。

【0160】そこで、次の層形成工程ではb-1に示すように、走査の方向に対する楕円の向きを90°回転させる。この向きで重ね合わせた層の状況は、b-2に示すようになって凹凸の絶対値は増大しない。

【0161】更に次の層形成はc-1に示すように楕円を回転させると、形成される層はc-2に示すようにムラを減少させる方向となる。そして、次の層形成はd-1、d-2に示すようになり、以降はa~dの回転を繰り返すことによって、積重ねられた層厚の高低ムラは増加することがない。

【0162】このような回転を行うためには、各回転方向毎に、スライス平面図からプリント信号を形成する時の変換条件を変えなくてはならない。すなわち、c-1~d-1に示すように図形パターンの方向を変化させてから変換を行わなければならない。それと同時に、樹脂液噴射工程112においては、受像面、すなわち液滴受け板面とインクジェットヘッドの走査方向を相対的に回転させる。最も簡単には受け板面を回転させてやれば良い。

【0163】なお、回転角の分割については、ムラ状況に対応させて任意に設定できる。但し分割が多い方がムラを減少させる効果は大きい、プリント信号変換時の演算は複雑化してしまうから、両者のバランスから分割を最適化するのが良い。

【0164】以上、立体物製作の各方法を詳細に説明したが、本発明で検討した上記立体物製作方法によれば、簡易な工程で簡易な装置で実行可能な立体物製作方法が得られる。また、立体物の体積に近い少量の紫外線硬化樹脂液でオペレートできる立体物製作方法を提供することができる。また、従来方法では製作不可能であった形状の立体物を製作可能とする方法が得られる。

【0165】また、立体物製作時の各層の厚さのムラを相互に補正して、フラットな仕上り面の立体物を得る製作方法が得られる。

【0166】

【発明の効果】以上説明したように、本発明は画信号に

基づいてレジストインクの噴射によりレジスト像を描画印刷するインクジェットプリンタを用い、形成すべきパターンの画信号をこのインクジェットプリンタに与えて被加工基材面上にレジスト用インクによるレジスト被膜のパターンを印刷形成することによってレジストパターン形成を行うものであり、この方法によれば、画信号の形で受信された情報に基づいて作成されたドライブ信号によって、制御されるインクジェットプリントヘッドから噴射されて、被加工基材上に付着するレジストインクによって、直接的に基材上にレジストパターンが形成されるので、パターンを露光させるための原版を必要とせず、写真の露光、現像工程が全く不要となることから、その分、資材も安価で済み、環境問題の心配もなく、設備や生産コストの点でも経済的となる他、画情報をプリントさせる構成であるから、レジストパターン形成が極めて容易であるなどの特徴を有するレジストパターン形成方法が得られる。

【図面の簡単な説明】

- 【図1】本発明の実施例を示す工程図。
 【図2】本発明の別の実施例を示す工程図。
 【図3】(a)は本発明によるレジストパターン形成装置の構成図であり、(b)はオリフィス板の正面図。
 【図4】本発明の別の実施例を示す構成図。
 【図5】従来例を説明するための図。
 【図6】従来の立体物製作方法を説明する図。
 【図7】従来の立体物製作方法を説明する図であって、(a)は装置構成図、(b)、(c)、(d)は層4A、4B、4Cの断面図。
 【図8】従来の立体物製作方法を説明するための図。
 【図9】立体物製作方法の第1実施例の工程説明図。
 【図10】立体物の断面図。
 【図11】インクジェットノズル配置例を示す図。
 【図12】立体物製作方法の第2実施例の説明図であ

り、(a)(b)は製作の対象とする立体物の一例を示し、(c)は製作の状況を説明するための図。

【図13】立体物製作方法実施例2の工程図。

【図14】図13の工程を具体的に説明するための図。

【図15】離型剤を立体物の境界面に噴射する方式における工程図。

【図16】立体物、支持台及び離型層の関係を説明する図。

【図17】離型剤を立体物の境界面に噴射する方式における図16での立体物、支持台及び離型層の各パターン図で、(a)～(e)は上記各パターン図の例を示す図。

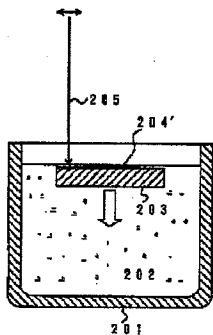
【図18】別の製作方法を説明するための工程図。

【図19】図18の製作方法を説明するための図であり、(a-1)～(d-1)および(a-2)～(d-2)は走査方向の組合わせ例及び形成される面の均一化効果を説明する図。

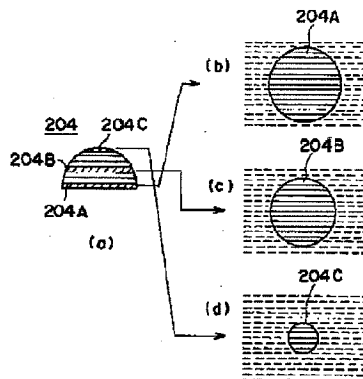
【符号の説明】

- 11…ベースプレート、12…ガイドポスト、13…ガイドポスト梁、14…昇降台、15…昇降台アーム、16、17…スライドレール、18、19…スライドベアリング、20…ベアリング受け、21…ワイヤフック、22…ワイヤ、23…ワイヤプーリ、24…モータ受け板、25…主走査モータ、27…カムフォロア、26…カムフォロア軸、29…カム、28…カム軸、30…副走査モータ、31…移動走査台、32…インクジェットプリントヘッド、33…オリフィス板、34…吸引支持台、35…吸引口、36…排気口、37…排気ファン、38…被加工基材、39…支柱、40…パターンCADシステム、41…受信回路、42…信号変換回路、43…ヘッドドライバ回路、44、45…モータドライバ回路、46…制御回路。

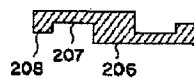
【図6】



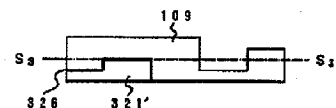
【図7】



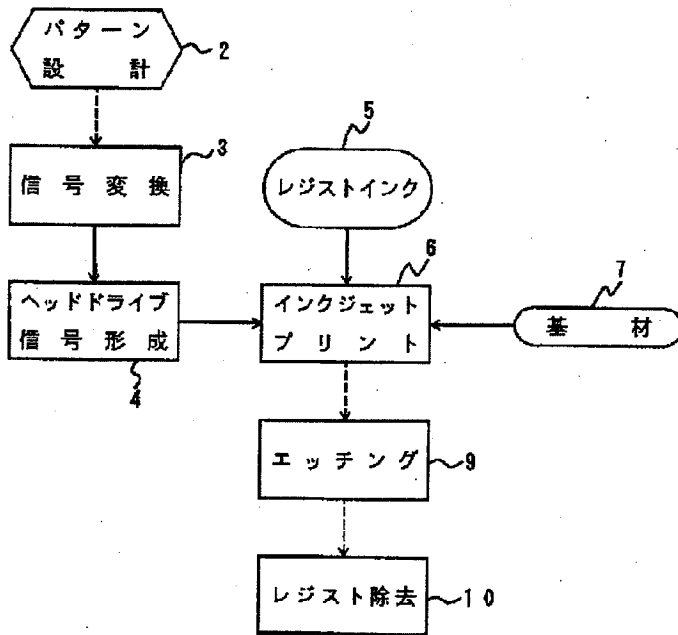
【図8】



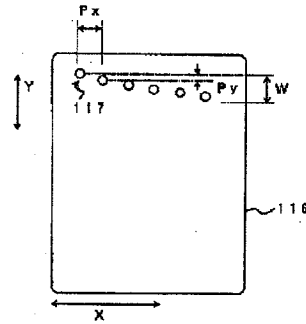
【図16】



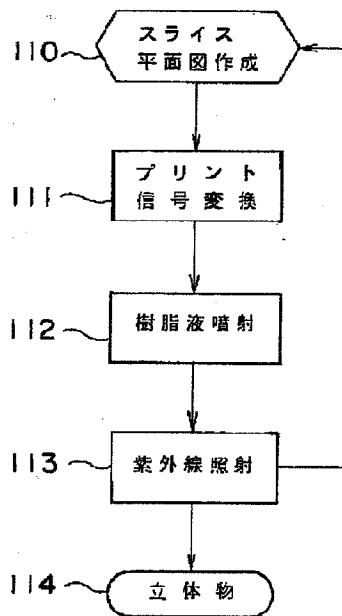
【図1】



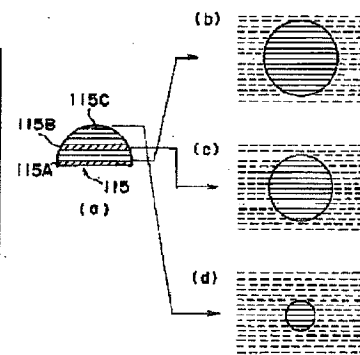
【図11】



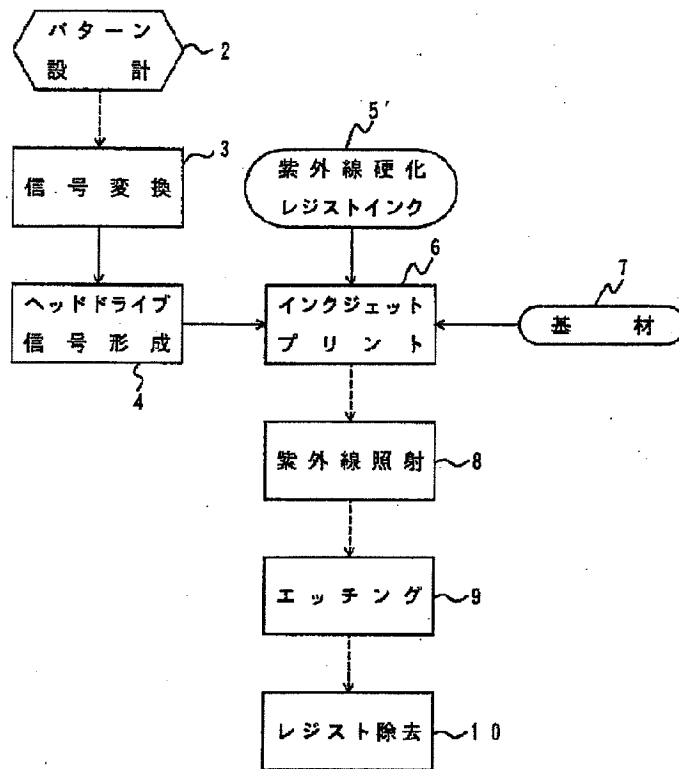
【図9】



【図10】



【図2】



【図12】

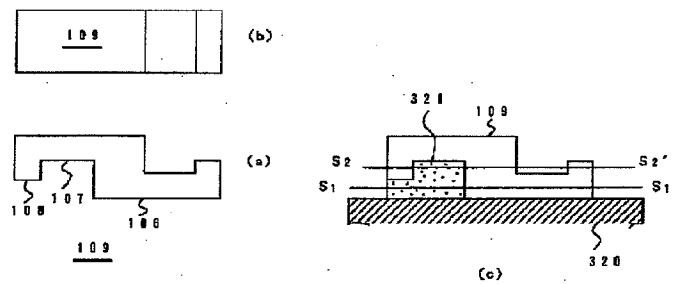
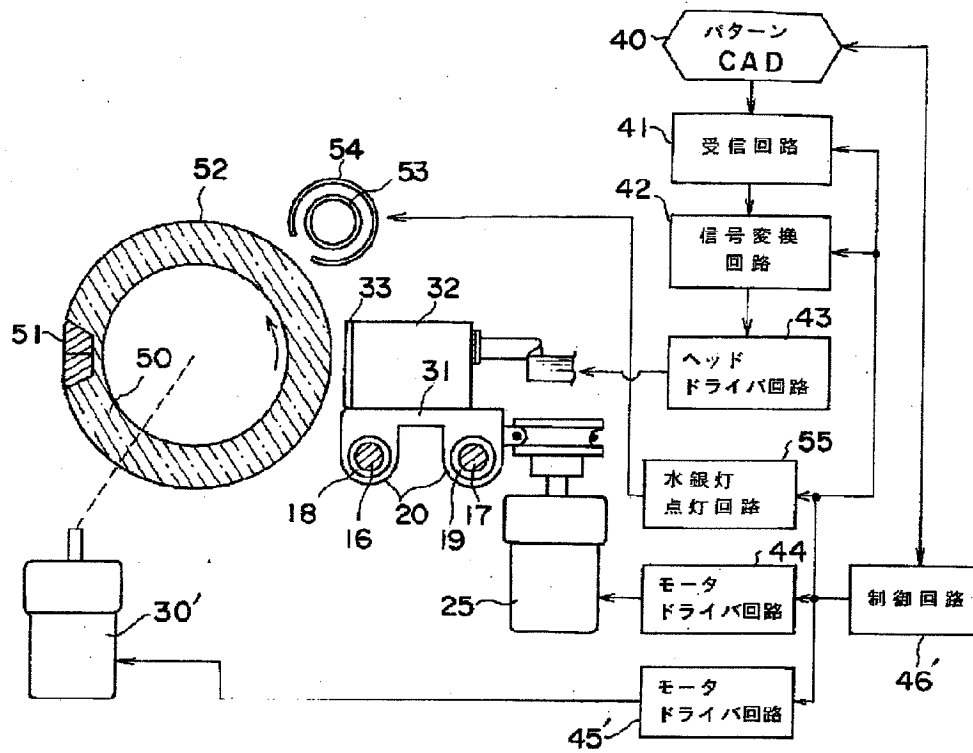


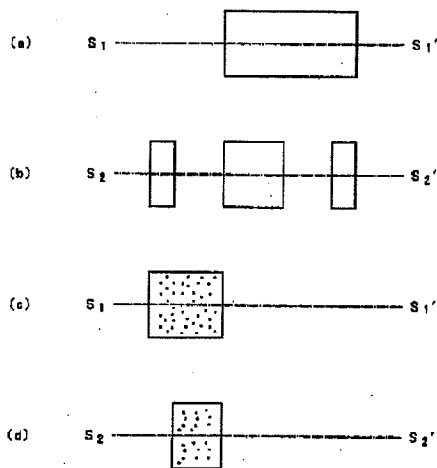
Figure 1(a) is a block diagram of the control system. It includes a 'パターンCAD' (Pattern CAD) block 40, which outputs to a '受信回路' (Receiving circuit) 41. The '受信回路' 41 is connected to a '信号変換回路' (Signal conversion circuit) 42. The '信号変換回路' 42 outputs to a 'ヘッドドライバ回路' (Head driver circuit) 43. The 'ヘッドドライバ回路' 43 is connected to the '制御回路' (Control circuit) 46. The '制御回路' 46 outputs to a 'モータドライバ回路' (Motor driver circuit) 44 and another 'モータドライバ回路' 45. The 'モータドライバ回路' 44 is connected to a motor 27, and the 'モータドライバ回路' 45 is connected to a motor 28. The motor 27 is connected to a pulley 26, which is part of a belt drive system with pulley 29. The pulley 26 is connected to a motor 30. The motor 30 is connected to a drawing surface 33. The drawing surface 33 is shown in detail in Figure 1(b).

Figure 1(b) is a detailed view of the drawing surface 33. It shows a rectangular surface with a series of small circles representing the drawing path. The surface is labeled with 'N' and 'W'.

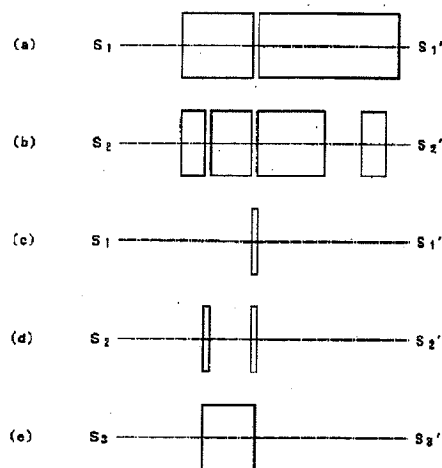
【図4】



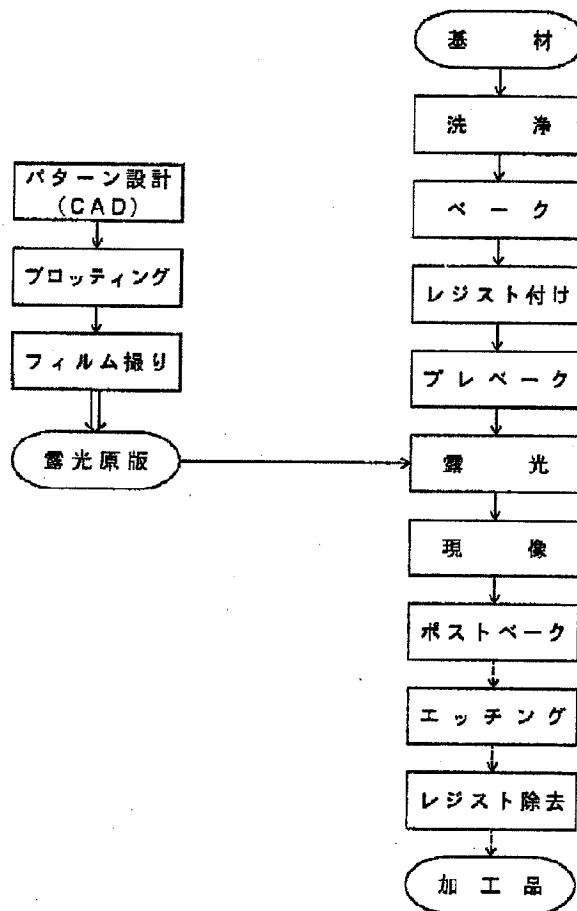
【図14】



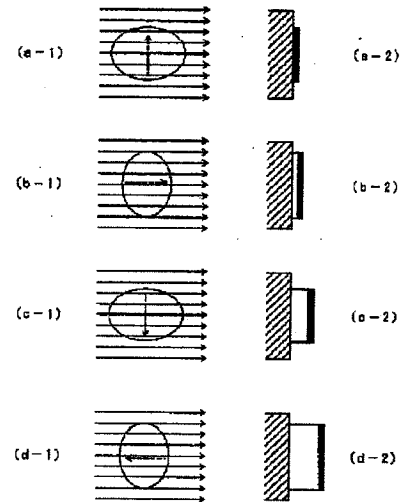
【図17】



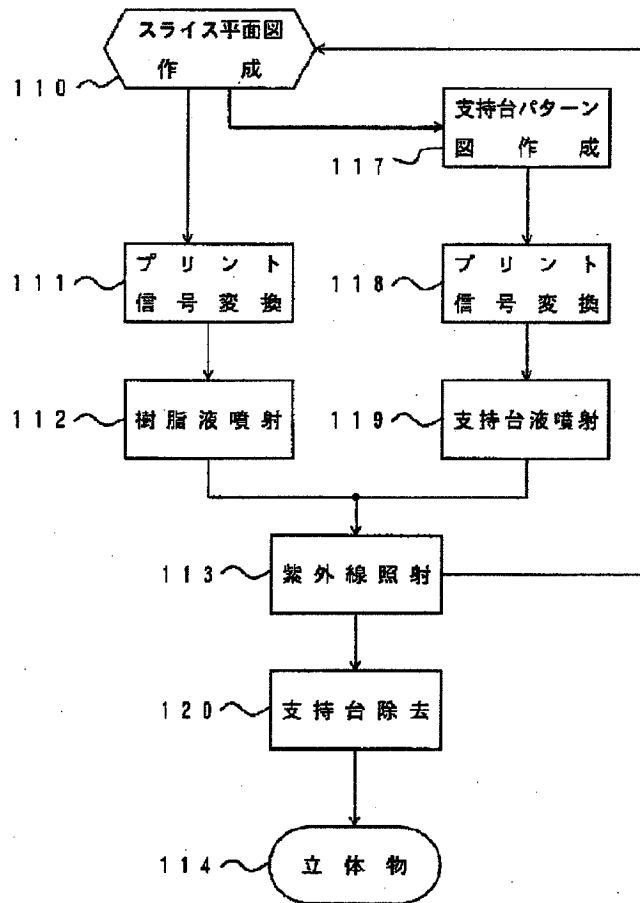
【図5】



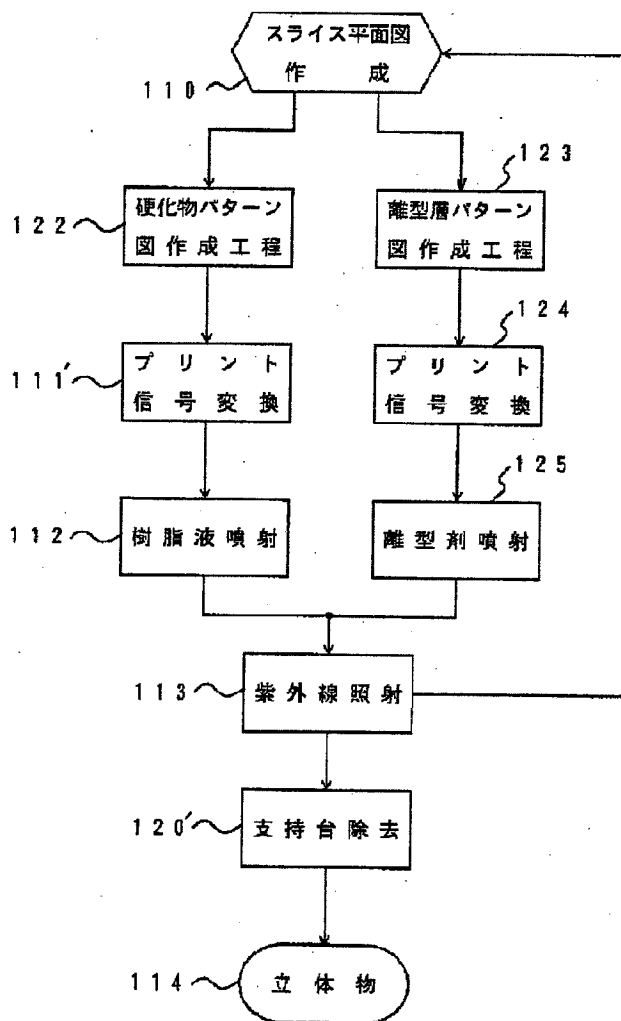
【図19】



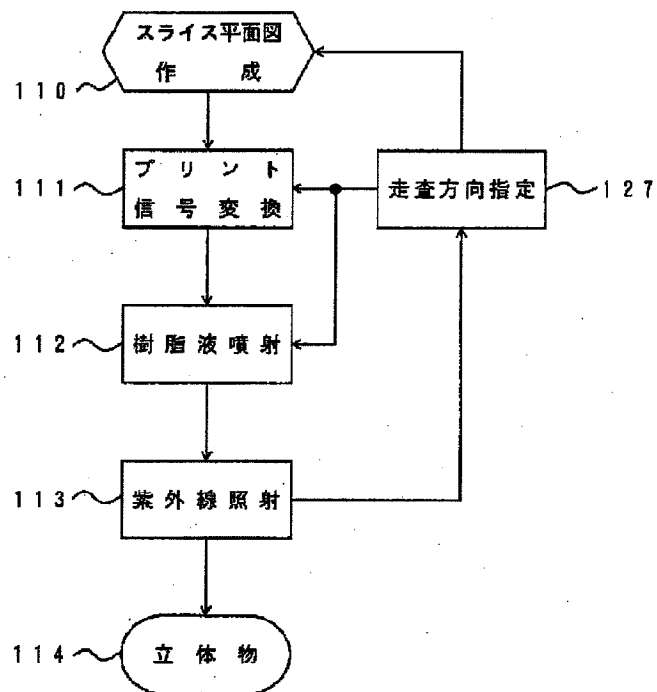
【図13】



【図15】



【図18】



フロントページの続き

(51) Int. Cl.³
H05K 3/18識別記号 庁内整理番号
D 7511-4E

F I

技術表示箇所